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[OFFICIAL NOTICE.]

New England Association of Gas Engineers.

SECRETARY'S OFFICE, BIRMINGHAM, CONN., Feb. 4, 1891.

To the Members of the New England Association of Gas Engineers:—

The meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, Mass., on Feb. 18 and 19, 1891. The meeting will be called to order by the President, Mr. C. F. Prichard, on Wednesday, at 10 o'clock A.M.

It is hoped that all the members who can possibly attend will be present.

The following papers have been promised:

"Renewal of Service Pipes and Street Mains," by H. A. Allyn.

"Note Books: Their Value, and how to Keep Them," by C. D. Lamson.

"Repairing Gasholder Tanks," by F. C. Sherman.

"Trouble in Purifying Gas from Sulphurous Coals," by N. W. Gifford.

In addition to the above, several papers are promised, but the subjects have not at the time of writing reached the Secretary. Probably they will appear in the next issue of the JOURNAL.

Persons eligible for membership and wishing to join the Association will please send to the Secretary for blank forms of application.

CHARLES H. NETTLETON, Secretary.

[OFFICIAL NOTICE.]

Annual Meeting of the Southwestern Gas Association.

SOUTHWESTERN GAS ASSOCIATION,
DENISON, TEX., Jan. 5, 1891.

We herewith hand you a programme of the next meeting of the Southwestern Gas Association, to be held at San Antonio, Tex., on the 10th and 11th days of next March. The officials of the San Antonio Gas Company have expressed a willingness to provide accommodations for all attendants at our next meeting. You can communicate direct with them. You will please bear in mind the knowledge to be derived from the discussions from the papers to be read at these meetings. We expect a good attendance, and must have you with us. Do not fail to come. Our Question-Box is open for your queries. Information can be had through it that can be received through no other channels. Trusting to be favored with your presence, we are,

Yours fraternally,
WM. ENFIELD,
J. R. CULLINANE,
Committee on Programme.

Programme.

Address of President, A. E. Judge, Austin, Tex.

"Advantages of a Gas Engineer Being a Member of a Gas Association," by the President.

"Gas Coals of the Southwest," by Wm. Enfield, Dallas, Tex.

"Condensation and Leakage in the Southwest," by C. P. Russell, Galveston, Tex.

"Regenerative Furnaces in the Southwest," by E. A. West, San Antonio, Tex.

"The Steam Jet Exhauster and Condensation," by J. C. Lord, Fort Worth, Tex.

"Candle Power in Competition with Electric Lighting," by Leonard Gill, Corsicana, Tex.

"Electric Lighting in Connection with Gas Lighting: Comparative Prices and Profits of Each," by J. J. Walsh, Paris, Tex.

"Fuel Gas and Gas for Fuel," by J. R. Cullinane, Denison, Tex.

"Gas Making in the Southwest: Its Advantages and Disadvantages," by Joshua Gill, Houston, Tex.

"Market for Residuals in the Southwest," by J. L. Brockenborough, Waco, Tex.

"The Commercial Possibilities of Gas," by Thos. Miller, Fort Worth, Tex.

"The Gas Man's Easy Chair: Has he One?" by Maj. Davis, Sherman, Tex.

"Mains, Services and Drips," by Elmer Jones, Paris, Tex.

"Gas Stoves and a Special Price for Gas as Fuel," by G. R. Vaughn, Houston, Tex.

"The Alternating Current," by J. H. Maxon, Waco, Tex.

"Carrying Gas into Mexico and to Mexicans," by M. L. Hickey, El Paso, Tex.

AUSTIN GAS LIGHT AND COAL COMPANY,
AUSTIN, TEXAS, Jan. 29, 1891.

Queries can be sent to me here, or to Secretary Russell, at Galveston, and we will deposit them in the "Question Box" for consideration at the next meeting of the Southwestern Gas Association, to be held at San Antonio on the 10th and 11th of March, 1891.

Vice-President West has made arrangements for those who wish to stop at the Menger Hotel, and he writes me that he will see about our getting such accommodations at reasonable rates.

The indications are that we shall have a good attendance and a pleasant and profitable meeting.

In the candid, free and good-natured discussion of our several experiences we will severally and collectively gain much useful knowledge; besides, our meeting in this way will make us better acquainted, will develop our fellow-feeling and sympathy for each other, which will ripen into life long and useful friendships. Fraternally yours,

A. E. JUDGE, Prest., Southwestern Gas Association.

BRIEFLY TOLD.

THE ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION.—In our current issue will be found a reminder from Secretary Nettleton that the time for the annual gathering of the New England Association is close at hand, and that, as usual, Young's Hotel will furnish shelter and afford comfort to the members and their guests. It is, of course, a truism now that the yearly reunions of the New England gas men are looked forward to with pleasure, since they have never yet failed to yield profit and satisfaction to those who have shared in the debates or joined in the good fellowship which mark the technical side and that permeates the social intercourse of those who pay allegiance to the Mother Association of the States, in respect to the gas industry.

This year, the Secretary evidently has experienced more than the usual amount of difficulty and uncertainty in securing the consent of writers to submit papers for the meeting: but there is good reason for such disinclination this time. In the East the current winter season has thus far been a most peculiar one—that is, owing to the eccentricity of the weather conditions—regarding the business of the gas maker. Probably no other more fickle winter season has been our lot in the past 15 years. At the close of November the biting frosts and blustering winds of mid-January were our portion, only to be succeeded in early December by alternate spells of murk and mist, of sunshine and shadow, of heat and cold—in fact, of those odd punctuations that put the gas man at his wit's end. The engineer knowing all too well what the difference is to his mental, quiet and bodily ease, when first confronted with 24 hours that will "average night time all round," only to be called upon in the succeeding 24 to experience what is known as "a gloriously, fine winter day." But so it has been thus far in the winter season of '90–'91. Under the conditions, then, the Eastern Engineer has had but scant time for paper writing. It is, however, certain that the list of papers now presented will be extended or added to before the meeting is called, and it is equally certain that those already guaranteed are bound to be of the interesting sort.

In the first place, we may look forward to something out of the common in President Prichard's inaugural; for that gentleman's scholarly methods and nice perception cannot fail of their natural result. His practice in Lynn is sufficiently diversified—in respect to the conditions governing the policy of the Gas Company there—to afford him a fruitful field for gleaning, and as he is known to entertain pronounced opinions on the theories of the Nationalists, perhaps we shall have the pleasure of listening to an exposition of those views that may be novel, and which cannot fail to be interesting.

In the list of papers, we note that Mr. Allyn, of Cambridge, is down to write on a subject (the renewal of service pipes and street mains) that is close to the thinking cap of almost every gas engineer in the country—and particularly so to those who have been waiting to determine what would be the ultimate effect on their send-out of the development of the incandescent electric light; for we presume that "renewal" may be fairly taken, in the matter of street mains at any rate, to include enlargement of calibre as well as simple replacement of original diameters. This is a most pressing subject with many gas companies, the proprietors of which have had ample opportunities in their immediate practice to completely satisfy themselves that pressure is not volume—whether measured in money to themselves or in satisfaction to their customers. Next in order comes a paper by Mr. C. D. Lamson, of Worcester, on the value of note-books, and how to keep them. The subject bristles with opportunities that Mr. Lamson is sure to take advantage of, and Boards of Directors well know the fateful significance of the engineer's note book; for its simple jottings have time and again determined the disposition of thousands of dollars of capital. Following Mr. Lamson, we are to have that veteran, Mr. F. C. Sherman, of New Haven, who is, from experience, admirably qualified to shed new light on the old-young problem of how to bring refractory holder tanks under subjection. Although this completes the current list of papers, we nevertheless are sure that the Secretary's intimation that other contributors may be counted on to appear in due time is in accordance with that principle of his never to overstate. In this knowledge we deem it certain that other papers are virtually promised, and that the list for '91, despite the odd season spoken about at the outset, will in no wise lose in comparison with the lists of other years.

THE AMERICAN PATENT SYSTEM.—We are indebted to the author, Mr. D. Walter Brown, of this city, for a copy of his book, entitled "The American Patent System: A Practical Guide to the Inventor and to the Investor," which is a reprint of a series of articles on the matters treated of in the title, originally published in the *American Machinist*. Mr. Brown, who is a lawyer by profession, directs his compilation not to the ordinary routine of the Patent Office in respect to the method of procedure in securing patents, or to the payment of the fees, etc., but aims, to use his own words, "to give a concise but very clear idea of the leading principles of American Patent Law," while on the other hand, "it does not aim to make an inventor a patent lawyer, but to enlighten him as to the nature of his rights," etc. In this we believe Mr. Brown has been successful. The book is divided into 8 chapters, and the matter of each is plainly put. It is nicely printed, and we wish we could add that the binding harmonized with the typography—this seems to be a case in point of the old saw prohibiting the would-be reader from judging a book by its cover. The copy sent us flares with red and gold, which might find appreciation in darkest Africa. Possibly the publishers have it in other bindings. The price of the book is 25 cents, postage not paid.

NOTES.—Treasurer William P. Taylor, of the Wilmington (Del.) Coal Gas Company, notifies us that a dividend of $3 per share has been declared on the operations of the last six months. It is payable on demand. ——The Tonawanda (N. Y.) Gas Light Company has increased its main system by the placing of 5 miles of pipe. Another noteworthy thing in connection with this Company is that, notwithstanding the competition of two electric lighting companies, its output for 1890 exceeded that for 1889 by a trifle over 20 per cent.——Some weeks ago Albert E. Hector, a lineman in the employ of the New England Telegraph and Telephone Company, brought suit for damages against the Boston Electric Light Company. Defendant, who operates a light wire over the premises No. 41 Temple Place, demurred to the suit on the ground that plaintiff was a trespasser in coming in contact with the light wire—Hector was making repairs to a telephone wire when he received the shock from defendant's wire that prostrated him—further that as both parties were mere licensees upon the building, plaintiff had no cause for action. Judge Dewey over-ruled the demurrer, and the case will go to a jury. ——Prior mention has been made in the JOURNAL of an injuction suit brought by Mr. J. K. Graves to restrain the Key City Gas Company, of Dubuque, Iowa, from failing to carry out an old contract under which he (Graves) for value received was to recive a free supply of gas to his residence for a certain number of years. Defendant contended that the contract did not permit Graves to demand an unreasonable supply of gas, and that as the Company had expressed a willingness to deliver to him per month 15,000 cubic feet of gas—which offer had been rejected—the Company should be permitted to remove its meter, and not be restrained from so doing. The Court sustained the Company, and the meter was removed. The case will be appealed.——The Decatur (Ala.) Light and Power Company, although only operated for 18 months, is more than earning the interest on its bonds. This speaks well for the skilful management of Mr. J. F. Rodgers.

[Prepared for the JOURNAL.]

[NUMBER IV.]

Chemical Studies for Gas Engineers.

By NORTON H. HUMPHRYS, Assoc. M. Inst., C.E., F.C.S.

The solutions of ammonia of 1° and 5° may next be prepared from the strong solution, following a procedure similar to that indicated in the case of hydrochloric acid. It will be obvious that solutions of any strength higher than that required can be used for the preparation of the test solutions. If the strength is at all doubtful, it may be roughly approached to by titrating a small quantity, say 2 septems, with carbonate, or acid, and thus data will be obtained for a more exact experiment. Suppose, for instance, that an acid, hydrochloric, nitric, or sulphuric, was found to neutralize, roughly, about 50 septems of carbonate, or of 1° ammonia. Its strength would then be about 50°, and in order to get a 6° or 7° solution from which to prepare the 5° or the 1°, we must dilute with 7 parts distilled water.

It is obvious that, since ammonia is an alkali, it cannot be titrated with carbonate, but that the hydrochloric acid must be used. The 1° and 5° solutions of ammonia must exactly neutralize equal quantities of 1° and 5° hydrochloric acid, respectively. Twenty septems is a convenient quantity to use, because since the burettes are graduated to one-fifth septem, the strength can then be adjusted to within 1 per cent. From the directions above given the reader will be able to prepare test solutions of any kind. Solid substances that are effected by exposure to air, such as baryta, potassa, etc, can be readily prepared by making a moderately strong solution, and with a greater approach to accuracy than would be received by weighing out the proper weight of the pure solid.

Having prepared the standard solution, the next thing will be an aspirator and some absorbing flasks. Any suitable shaped vessel, having a neck at the top and another at or near the bottom, may be used. A convenient arrangement for use in gas works consists of a flat-shaped vessel, either cylindrical or rectangular, say about a foot in diameter, and 6 inches deep, made of sheet iron or copper. It should be mounted on a wooden stand, of convenient height for measuring vessels underneath to receive water from the aspirator, and the flat top of the latter will serve as an operating table for the reception of the absorbing flasks. A second neck may be added at the top to take a filling tube, which must reach nearly to the bottom, and have a funnel at the top. A short piece of tube with adjustable stopcock should be fixed to the neck at the bottom. Several forms of absorbing flasks or tubes are kept in stock by makers, such as Liebig's tubes, Todd's tubes, various arrangements of bulb tubes, Volhard's flasks, etc., and I find a form known as Sheard's modification of the latter to be as good as any. This consists of a light, conical flask, capable of containing about 4 ounces. A tube comprising two bulbs and a cylindrical prolongation is fixed into one side close to the bottom, and bent at right angles so as to bring the bulbs and cylinder to a vertical position. To fit up for use, provide each neck with a well made rubber stopper, perforated to receive a glass tube. Use glass tubes of $\frac{1}{4}$ to $\frac{3}{8}$ inch bore for the connections. A small elbow will do for the inlet and also for the outlet, and the outlet of the first flask may be joined to the inlet of the second by a bent piece of tube passing through both stoppers. The cylindrical part is filled with large glass beads, or broken glass.

Having filled up the aspirator, also a set of two absorbing flasks, and made a connection from the outlet of the last flask to the inlet of the aspirator, the next thing is to charge the flasks. These must contain an excess of acid, so we must roughly guess at how much ammonia may be expected. If we are operating on crude gas at the condenser, we may expect about 1½ grains per cubic foot. Since one septem of standard 1° acid = .017 grains of ammonia, about 60 septems would = 1 grain. We decide to pass 0.2 cubic feet of gas which would mean about 0.3 grain ammonia, and require 18 septems of acid to neutralize it. But as we must be on the safe side, we put 25 septems of 1° acid in the first flask and 5 in the second. This is poured in through the cylinder containing the bits of glass, so as to moisten them with the acid. To insure the proper action of the flasks they must contain as much liquid as will about fill one of the bulbs, which should be about 40 septems. This quantity must be made up with pure distilled water, which should not be poured down after the acid, but added through the neck proper of the flask, so as to avoid disturbing the beads saturated with acid. A suitable testing tube is then introduced into the gas main pipe at a convenient place, and furnished with a stopcock. To the outlet of this stopcock is screwed a tar filter of the kind already described, and to the outlet of this is fitted a nosepiece for receiving an india rubber tube connected to the inlet of the first flask. The aspirator has been charged full of water, and a $\frac{1}{10}$ ft. Wanklyn bottle or other convenient measure placed under the outlet. Before commencing the experiment, the filter and tube are filled with gas, by allowing it to escape for a minute if under pressure, or connecting it directly to the aspirator, and running out a little water if under exhaust. This having been done the rubber tube is closed by a pinchcock, and the connections made up as described.

We are now able to study the action of the absorbing flasks. When out of use the liquid lays in a thin layer over the bottom, just enough to seal the outlet tube. The inlet is through the neck proper of the flask. Everything being in readiness, open the top of the aspirator sufficiently to allow water to drop out in a smart succession of drops. The pressure of the gas, or the suction of the aspirator, will cause the bulk of the liquid to rise up into the lower bulb, and bubbles of gas will begin to pass through. When this obtains, close the tap. The liquids should retain their place in the bulbs, if all is sound. If they gradually fall and return to the flask, there is a leak somewhere, which must be found and stopped. Perhaps one of the stoppers does not fit, or there may be a crack or pin hole in the tube. The best quality rubber tube should be used, and this should be well rubbed with hard grease from time to time, to keep it from getting dry and cracking. If this is not attended to the tubes soon get leaky, especially if used in a warm place. Having satisfactorily proved the soundness of the apparatus, open the tap again and allow the water to drip off as before, until nearly the quantity required has been drawn off. The quantity of water so removed represents the bulk of gas passing through the flasks. A little before the end, turn off the water for a minute or so, and then draw off the last portion drop by drop. We decided to pass one-fifth of a foot, and, therefore, draw off one-fifth of a cubic foot of water, or about 10 pints.

Disconnect the apparatus, and thoroughly wash all acid, etc., off the beads into the flasks, by 3 or 4 washings of warm distilled water, poured in at the top. For ordinary purposes, these solutions may be directly titrated in the flasks, but if a greater degree of accuracy is required they may be transferred into beakers, and after ascertaining that they are freely acid, boiled to expel carbonic acid and sulphureted hydrogen, which are rather apt to interfere with the delicacy of the end reaction. In this case, however, sulphuric acid must be used as the standard acid, as hydrochloric is liable to lose strength by exposure to boiling point. Assuming that the plain titration will do, we tinge the liquid decidedly with litmus, and drop in 1° ammonia from a burette until the blue coloration is produced. If the experiment has been properly conducted, practically the whole of the ammonia will be absorbed in the first flask, and the second will not absorb more than a mere trace. It acts as a catch-box. Suppose 7.4 septems of ammonia are required to produce the blue coloration in the first flask, and 4.8 in the second. We thus find that the first has given 25 — 7.4 = 17.6, and the second 5 — 4.8 = .2, or 17.8 septems of acid in all for absorption by the ammonia contained in the crude gas. This represents 17.8 × .017 = .302 grain. A cubic inch of ammonia gas weighs .181 grain, so this is equal to 1.66 cubic inches. Remembering that the ammonia was absorbed *before* measuring, for 346 cubic inches of gas we have 1.66 of ammonia, which works out to 8.24 cubic inches, or 1.49 grains per cubic foot, or rather less than 0.5 per cent. by volume.

This experiment may be extended by placing a wet meter between the outlet of the flasks and the inlet of the aspirator. The aspirator may then be emptied several times, and a test lasting for several hours, including several cubic feet of gas, can be taken. The quantity of gas passed is measured by the meter, and if the gas is under pressure the aspirator will not be needed. This method may be resorted to for testing pure gas as supplied to the public, which ought not to contain more than 0.5 grain per 100 cubic feet. The method of repeating each experiment at the outlet of scrubber or washer will be obvious, and the student need not feel himself limited to 1° or to 5° solutions. Any convenient strength may be used, though solutions stronger than 5° are not recommended. A $\frac{1}{2}$° solution of acid, with a corresponding one of ammonia, is convenient for testing pure gas. In all cases the acid should be in *excess* at the close of the absorption.

The flasks as above described may also be used for the estimation of ammonia in liquids. The liquid to be tested is placed in a 16-ounce flask, fitted with a rubber stopper carrying two tubes, one a "safety funnel," and the other an eduction tube, bent to the necessary form and terminating in a rubber stopper that fits the inlet of the flask. The eduction tube should have 2 or 3 bulbs blown upon it, or else be of large bore—not less than ½-inch—and stand in an upward direction away from the distillation flask, so that any liquid carried over with the steam may be returned, and not pass on to the acid. One absorption flask will be sufficient in this case. Every degree of Twaddell (best ascertained by the specific gravity bottle) represents about 300 grains of ammonia per gallon. A convenient quantity for testing will be 50 septems ($\frac{1}{70}$ gal-

lon) of weak, or 20 septems ($\frac{1}{175}$ gallon) of strong liquor. The larger will require at least 20 septems of 5° acid, and the smaller 8 septems, to be placed in the absorption flask for every degree Twaddell. Suppose we are about to operate on a 6° liquor; 20 septems in the distilling flask should have 50 septems of 5° acid in the absorption flask.

The apparatus is fitted up so that the distillation flask is supported over a small rose burner, and the absorption flask supported at the height necessary to enable the eduction tube to be connected up to it. This may be done by means of wooden blocks about 4 inches square, and of varying thicknesses. A set comprising two dozen or so, ranging in thickness from 3 inches to $\frac{1}{4}$ inch, will be found very handy for purposes of this sort. All being in place, the 50 septems of 5° acid are poured down the outlet end of the absorption flask; next the 20 septems of liquor are put in through the safety funnel of the distillation flask, and washed down with distilled water. An excess of potash solution is next poured down the safety funnel, in order to secure the evolution of the whole of the ammonia. To prepare this, dissolve about one ounce of pure stick potash in 4 ounces distilled water, and preserve in a good stoppered bottle. About 20 septems of this solution will be sufficient; rather more may be used if the sample of liquor is strong, and less if it is weak. After the potash solution, add sufficient distilled water to fill the flask about two-fifths. Then apply a gradual heat so as to bring the liquor to a very gentle boil. After 15 minutes this may be so adjusted as to allow the liquid to boil steadily but briskly. The boiling should be continued for at least 30 minutes, and at the end of that time the absorption flask should be disconnected, without stopping the boiling. Apply a piece of red litmus paper (paper dipped in a solution of litmus that has been reddened by the addition of a few drops of sulphuric acid) to the steam issuing from the eduction tube. If the paper remains unchanged in color, all the ammonia has come over; but if it turns blue, the absorption flask must be connected up again and the boiling continued for some minutes, after which a second test may be taken. When all the ammonia is driven off, disconnect the apparatus, empty out the distillation flask, and wash out clean in readiness for a future experiment. Take the absorption flask, and wash the glass in the cylindrical part by pouring in three or four small portions of distilled water in succession. Fill a burette with 5° ammonia, tinge the liquid in the flask with litmus, and titrate. Suppose 8.8 septems of ammonia are required to produce a neutral tint. Then the ammonia present in the liquor has absorbed $50 - 8.8 = 41.2$ septems of acid. This quantity must be multiplied by .085 to get at the number of grains of ammonia present, and, since the quantity operated upon was $\frac{1}{175}$th of a gallon, by 500 to give the ammonia in grains per gallon of liquor. The result will be—

$$41.2 \times .085 \times 500 = 1{,}751 \text{ grains.}$$

This represents the whole of the ammonia, including that which is free—*i. e.*, that would be given off by simply boiling the liquid, and that which is fixed in a non-volatile form, so as not to be given off by the boiling. To separate these two forms, a second experiment may be tried on the same lines as the above, but without adding potash to the distillation flask. The liquid in the absorption flask should be poured out into a beaker and raised to boiling point, with stirring by a glass rod, before titration. The quantity of acid absorbed will be found to be rather less than in the above. Suppose it is 37 septems. Then

$$37 \times .085 \times 500 = 1{,}572.5 \text{ grains per gallon of } \textit{free} \text{ ammonia.}$$

The difference gives the quantity of *fixed* ammonia—

$$1{,}751 - 1{,}572.5 = 178.5 \text{ grains.}$$

The free ammonia may also be ascertained more rapidly, though not with so great a degree of accuracy, by putting 20 septems of the liquor into a beaker, diluting with distilled water, and adding gradually, with stirring, 50 septems of 5° acid, which, for this experiment, must be sulphuric, and not hydrochloric acid. After effervescence has ceased, boil briskly for a few minutes, then titrate in the usual way with ammonia. Liquids cannot be accurately titrated with ammonia while hot. They should either be allowed to cool, or else titrated with a fixed alkali, such as potash or soda.

Sulphate of ammonia may also be tested in a similar way. The pure salt should contain 25¾ per cent. of ammonia, and that manufactured at gas works in the usual way should contain not much less than 25 per cent. The value of the salt to the purchaser is represented by the proportion of ammonia present, and, therefore, it is well to be able to ascertain this, as disputes may arise. Take a fair sample of the sulphate, finely powder, and weigh out 2 lots of 35 grains each. This quantity is selected as being $\frac{1}{175}$ part of a pound. Place one in the drying oven, and dissolve the other in distilled water in a test mixer. When dissolved, make the solution up to 3,000 grains with distilled water, and well mix. Set up the distilling and absorbing apparatus, charging the latter with 50 septems 5° acid. Measure out 1,000 grains of the solution, and test with blue litmus paper. If decidedly acid, set aside for testing for "excess of acid," and take a second 1,000 grains. Transfer this to the distillation flask, add 20 septems of the potash solution, together with sufficient water, and distil as before. In all cases the apparatus should be put together, and the absorption flask charged, before pouring in the liquid to be tested. Boil as above described till all ammonia is given off, and then titrate. Suppose 16 septems of standard ammonia are needed, then 34 have been absorbed by the ammonia from the sulphate. As we took one-third of the 35 grains, this quantity would represent $34 \times 3 = 102$ septems, and $102 \times .085 = 8.67$ grains ammonia. This is equivalent to 25 per cent. of ammonia.

Any excess of moisture present will be ascertained by the loss of weight on the part put into the drying oven. And excess of acid, if such exists, may be found by titrating with 1° ammonia. Each septem of ammonia required represents .049 grain sulphuric acid. The sample examined above contains $25 \times 100 \div 25\frac{3}{4} = 97.1$ per cent. of pure sulphate, and the remainder will consist of moisture and excess of acid.

It is a usual custom with buyers to stipulate that the sulphate shall contain not less than a certain percentage—say 24 or 25—of pure ammonia.

Carbonic acid in gas can be tested by means of the absorbing flasks and aspirator as used for ammonia, but the reagent in this case is baryta water. This is prepared by dissolving 1 ounce of pure barium hydrate in crystals in one quart of distilled water. The same should be preserved in a well stoppered bottle, capped, as it rapidly loses strength by exposure to the atmosphere. On this account it is better not to attempt the preparation of a standard solution, but to obtain the value of the solution used at each experiment, in terms of acid. To do this, carefully measure out 20 septems of baryta solution, place it in a flask, add 100 septems or so of distilled water, and titrate with 1° hydrochloric or nitric acid. Each degree of strength is equal to .022 grains carbonic acid per septem, and if we find the baryta requires 38 septems of 1° acid, we know that its strength is $38 \div 20 = 1.9°$, and that each septem is equivalent to $.022 \times 1.9$ grains of carbonic acid. If we intend to test the crude gas, we may expect to find about 3 per cent., or say 24½ grains per cubic foot. We therefore decide to pass $\frac{1}{5}$ cubic foot of gas, and charge the first absorbing flask with 40 septems, and the second with 20 septems of the baryta water. Remembering that it loses strength by exposure to air we take care to do this as rapidly as possible, and not to put in the charge until just before starting the experiment, and to close up the flasks at once. The flasks are to be charged with the same precautions as were used in putting in the acid, taking care to saturate the glass beads with baryta solution.

If this experiment is conducted in the flasks that were used for the acid solution, care must be taken that they are thoroughly washed out both before and after the experiment. If an extended set of experiments is contemplated, it is better to have a separate set of flasks for alkaline absorptions. Baryta solutions can be titrated with litmus as indicator, but phenolphthalein is better. This is a powder which when dissolved in alcohol yields a brownish solution. A drop or two added to a solution containing free alkali, gives an intense crimson red. The color disappears entirely when the solution is neutral and the action is very distinct, a single drop being sufficient to give the desired effect. It cannot be used with ammonia.

Having passed $\frac{1}{5}$ cubic foot of gas through the flasks, by drawing off 2½ pints of water from the aspirator, disconnect the apparatus, and carefully wash the solution off the glass packing and bulbs into the flasks. Carefully cork up with plain corks until quite ready to titrate. Suppose we find that the first flask requires 18 septems, and the second 33 septems of acid to neutralize. The charge in the first was equal to $1.9 \times 40 = 76$ septems 1° acid, and that in the second to half that quantity or 38 septems. We, therefore, find that the first has absorbed carbonic acid equivalent to $76 - 18 = 58$ septems, and the second $38 - 33 = 5$, or 63 septems in all. $63 \times .022 \times 20 = 27.7$ grains of carbonic acid. Since 1 cubic inch of this gas weighs 0.47 grain, 27.7 grains is equal to 59 cubic inches, or 3.4 per cent. by volume.

Another way of proceeding is to pour off the liquid from the flasks into a large flask fitted with a sound cork, taking care to wash out all the white sediment. Allow this to settle, and then carefully pour off as much of the clear liquid as possible, taking care not to lose any sediment. Make up with clear distilled water, agitate, allow it to settle, and again pour off the clear liquid, taking care to avoid unnecessary exposure to air. Carefully pour the white sediment on to a filter, rinsing the flask with a little distilled water until every particle of the sediment is transferred to the filter (the methods of making a filter are described in any book on chemistry), and wash with distilled water two or

three times, or as long the washings act on red litmus or turmeric paper. Filtering paper of the best quality should be used, which will only yield a very little ash on burning—not more than a few hundredths of a grain. Dry the filter and contents, and when quite dry ignite in the platinum capsule, taking care not to spill any of the ash or sediment, and maintain at a red heat until quite white and clean. Cool under the desiccator, and weigh. Carefully empty the crucible and wipe it out; then find the weight of the empty crucible, and this deducted from the previous weighing gives the weight of the sediment. This experiment can be tried after the solution has been titrated, and the operator can thus test his skill. The weight of sediment in grains will be about 2 per cent. less than the number of septems of 1° acid divided by 10. In the example above given it should be about 6.17 grains. To get at the quantity of carbonic acid, multiply by .224, which gives 1.382 grains, or 27.64 grains per cubic foot.

In testing for smaller percentages of carbonic acid, weaker solutions of baryta may be used, or larger quantities of gas passed. The results obtained per cubic foot can readily be calculated out to show the quantity of carbonic acid present in the crude gas and requiring to be removed, for a day, month, or year; and the successful operation or otherwise of the purifying operations can be indicated.

And here I propose to leave the subject. Much more might be said about it, but the object in view is to present rough sketches that will arouse a spirit of interest in the experimental department of gas engineering, rather than anything in the way of an exhaustive treatise. With the experience gained by carefully following and working out the experiments just related, the student will be able to proceed to other and more intricate investigations, always remembering that if an experiment is worth doing at all it is worth doing accurately, taking care to clearly grasp the why and wherefore of each detail. A careful, systematic record of each test should be kept in an indexed book, so that the results may be available for reference at any time; and it is well to put down not merely the conclusion, but the full procedure in each case, such as quantities of materials or reagents used, and all the calculations.

Fenney's Patent Pipe Cutting Machine.

The London *Journal*, in bringing this apparatus to the attention of its readers, says that all who have had any experience in laying or repairing cast iron gas or water pipes will admit that the old system of cutting them, by chipping round and breaking off, is a wasteful and expensive method, which, as a general rule, results in a very ragged job when completed. The work is attended with some trouble, even if the pipe is above ground; but the difficulty is considerably increased when it is in a trench. An attempt has been made by Mr. T. F. Fenney, of

Fig. 1.

Stockton-on-Tees, to facilitate the cutting operation under both conditions, by the use of the appliance shown in the accompanying illustrations. It is made in various sizes, No. 1 being capable of dealing with pipes up to 6 inches in diameter; No. 2, those from 6 to 12 inches; and the others with larger makes—each machine having a working range of 6 inches. Where the pipe to be cut is outside its trench, a machine up to size No. 4 (which will cut a pipe from 18 to 24 inches in diameter) can be fixed by two ordinary men in about five minutes, and an 18-inch

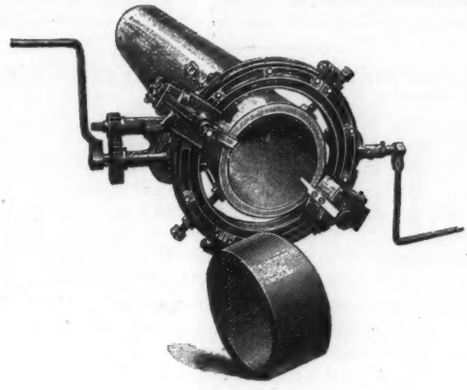

Fig. 2.

Fig. 3.

pipe cut completely through in rather more than 20 minutes; the whole operation consequently being performed in half an hour.

It will be obvious that this is a very considerable saving of time as compared with that occupied under the usual process of chipping. Taking the case of a pipe lying in its trench. By the old system, a groove could only be chipped half way round; and it was frequently impossible to obtain a good square end until after several hours' work. Even then the twisting, levering, and hammering which the operation necessitates, not unfrequently cause the next joint to spring, and give rise to serious trouble. With one of Mr. Fenney's machines, however, all this may be obviated. It must be acknowledged that a little more earth will have to be removed, to allow the machine to be put round the pipe; but this is a small matter. The appliance can be worked in a trench as shown in fig. 1 or fig. 2; but the driving arrangement in fig. 1 has been specially designed for this purpose. The pipe is then cut without any strain or hammering; and when a valve, junction, or anything of the kind, has to be put in, the piece to close the opening can be cut to the right length before being taken out of stock—the size of the opening being known exactly; while by the old system the closing-piece is not cut until after the opening has been made.

One of the advantages claimed for this machine is that of cutting out the lead joints for disconnecting pipes. By the old system, about a foot of pipe is wasted in each pipe taken up, by being broken off and left in in the socket; but by changing the slide rests of the machine as in Fig. 2, it can be fixed in the socket of a pipe. In this way the joint of an 18-inch pipe 3½ inches deep, has been cut out in rather more than half an hour. This rapidity of operation—a very important matter in the case of repairs of gas or water mains—is a quality which should commend the appliance to the notice of those who have to carry out work of this kind.

Referring to the illustrations, the machine shown in Fig. 1 is a No. 8 size, as used by the Liverpool Corporation for cutting 44-inch pipes, with the arrangement attached for working the machine in a trench. When employed for cutting pipes outside a trench, this part of the appliance is removed, and brackets and handles are substituted, as in Fig. 2. In this figure, the machine shown is a No. 3, for cutting pipes from 12 to 18

inches in diameter. Here both the tools—one for cutting the pipe, and the other for cutting out the joint—are to be seen; but, of course, each is removable if not required. Fig. 3 is a back view of Fig. 2, and is similar to the back view of Fig. 1, with the exception of the additional set-screws which the larger machine requires for fixing it to the pipe.

Compressed Air for the Transmission of Power in Paris.

The Popp system of distributing power from central stations to large cities, for the use of small and medium sized industries, has taken a wonderful development in Paris, and has attracted considerable attention in this country. The earlier plant at Paris appears to have been very deficient, and through the intervention of Professor Reidler, the leading authority on the design of pumping and blowing engines, wonderful progress has been made. Professor Reidler has lately placed before the public the results of a very elaborate series of experiments carried on chiefly by Professor Gutermuth. These experiments, often made at a considerable sacrifice to the enterprise, have been embodied in a preliminary report placed before the Verein zur Beforderung des Gewerbfleisses at Berlin. The original central station at the Rue St. Fargeau, which was visited by the American Engineers during their stay in Paris, consisted of Paxman compressors, having a total horse power of 2,000. To these were added subsequently 5 Cockerill compressors of the Dubois Francois type of 2,000-horse power. There is now in course of construction a new central station, located on the Seine at the Quai de la Gare, planned for 24,000-horse power, of which one third will be in operation this spring. The first step taken by the German expert was to determine accurately the efficiency of the compressors in use at the old station. It was ascertained that the six Paxman compressors showed an efficiency of 7½ c. m. compressed to 6 atmospheres per horse power per hour. The Cockerill compressors did better, having an efficiency of 8.5 c. m. Reidler modified the latter, making it practically a compound compressor, the first step being to compress to 2 atmospheres, delivering into an intermediate reservoir, where the air was cooled, and subsequently compressing in a second cylinder to 6 atmospheres. The result was that the efficiency was raised to 10.4 c. m. In detail the results are embodied in the following table:

Efficiency of Compressors.

Type of Compressor.	Revolution.	Indicated Horse Power.	Pressure. Atmosphere.	Efficiency. Per Ct.	Air Delivered.- Per Revolution. C. M.	Air Delivered.- Per Hour. C. M.	Air Delivered.- Per H. P. Per Hour. C. M.
Paxman (600 mm. and 550 mm. diameter, 1,219 mm. stroke, 23.6 and 21.7 × 48 inch).	37.	302	6	0.87	1.18	2620.	7.40
		258			1.08	2378.	7.82
Cockerill (600 mm. diameter, 1,200 mm. stroke, 23.6 × 46.25 inch).	40.	337	6	0.83	1.32	3168.	7.98
	45.	353	6	0.83	1.32	3564.	8.56
	40.	342	6	0.88	1.408	3379.2	8.40
	46.	377	6	0.85	1.36	3753.6	8.46
	38.6	324	6	0.89	1.423	3303.6	8.67
	38.5	337	6	0.89	1.422	3287.6	8.33
	38.6	829	6	0.91	1.445	3346.	8.64
Reidler, 1,090 mm. low pressure, 670 high pressure, 1,200 mm. stroke, 42.91 and 26.58 × 46.25 inch.	52.	615	6	0.985	2.196	6848.	10.020
	60.	709	6	0.98	2.180	7902.	10.026
	38.	422	6	0.985	1.195	5000.	10.656
	39.	424	6	0.985	2.195	5136.	10.890

The new central station at the Quai de la Gare is located on the Seine, so that coal can be cheaply delivered by water, and there is a full supply of water for spraying in the compressors and for the condensers of the engines. The engines are triple expansion, according to the latest designs, and are to be built by Schneider & Co., of Creusot, who guarantee 700 grammes of fuel per hour per horse power, with penalty of 20,000 francs for each 100 grammes excess. The Paxman compressors worked with a consumption of steam of 9 kg. per hour, while the Cockerill engines required 8, and it is believed that the newly designed engines will come down to 5.3 kg. The engines are vertical, because there is little space, and the compressors will be compound, the air being drawn from outdoors, compressed in the low pressure cylinder, delivered into an intermediate reservoir, where it is cooled, and finally brought up to normal pressure in the high pressure cylinder.

The one important feature developed in practice with the Popp system in Paris is the heating of the compressed air before it is delivered to the engine acting as the motor. In this manner the disadvantages of the formation of ice are avoided, the air is expanded and its capacity for work increased. The heating ovens introduced by Popp are cast iron stoves with cell walls and simple internal heating. They are simple and readily placed in position; but it is hardly claimed that this cast iron stove should be considered an ideal heating apparatus. The following table gives the results of experiments made on the stoves, showing their efficiency, as measured by the amount of work utilized in heating the air:

Efficiency of Heating Stoves.

	Cast Iron Stove.		Wrought Pipe Stove.
Heating surface, square meters	1.3	1.3	4.3
Volume of air heated per hour, cubic meters	576	3.3	1,088
Temperature of air entering, deg. Cel.	7	7	50
Temperature of air delivered, deg. Cel.	107	184	175
Calories, per hour	17,900	17,200	39,200
Calories, per square meter, heating surface	13,760	13,230	9,100
Calories, per kilogram coke	4,470	4,530	5,600

The consumption of fuel per hour is 0.09 kg. per effective horse power of the air motor. This consumption of fuel is so small that even with large engines it does not play an important part. A more efficient apparatus for heating would make it possible to give the compressed air so much heat that all losses in compression are made good, and that even more power can be delivered than was originally applied to the compression of the air. A further development is possible by a heating apparatus so arranged as to pre-heat in one apparatus and carry the temperature higher in the second one. The influence of double heating of this kind is shown by the following results of an earlier trial in which two engines were coupled, one behind the other:

Coupled 4 and 6 Horse Motors with Double Heating.

Pressure, atmospheres	5.5	5.5
Horse power developed	6.11	6.0
Temperatures air of motors on entrance	110° C.	65°
" " " exhaust	150° C.	100°
Consumption of compressed air per hour per horse power, cubic meters	20.4	18.3

The consumption of air per horse power declined from 23 c. m. in the case of the single engine to 20.4 and 18.3 c. m. per hour, when preheating as moderately as stated. The engines in question were very deficient old steam engines. The rapid development of this system made it impossible to choose the very best motors. Small rotary motors were experimented with, yielding the following results. Formerly they consumed 70 c. m. per hour per horse power, which is equivalent to an efficiency of 15 per cent. The details of their work are shown in the following table:

Efficiency of 1-Horse Power Compressed Air Rotary Engines.

Revolutions	Pressure, Atmos.	Horse Power.	Temperature. Admission.	Temperature. Exhaust.	Air per H.P. per Hour Without Heat'g. C.M.
91	4.0	0.755	16°	—10°	84.2
117	4.0	0.93	16°	—10°	83.4
187	4.0	1.08	16°	—15°	55.1

When running at higher speed they actually consumed 30 to 40 per cent. less. Here the investigation confirmed the assumption that the pistons were not tight, so that the losses were less at a higher speed. The same is true of small crank motors. The following table gives the results of a number of tests of this class of engine, with 4 atmospheres air pressure indicating the results obtained and cut-off:

Efficiency of Small Rotary Engines.

Engine.	Revolutions.	Horse Power at Brake.	Air Temperature. Admission.	Air Temperature. Exhaust.	Air Consumption per H. P. per Hour. Without Heating. C. M.	Air Consumption per H. P. per Hour. With Heating. C. M.
Old rotary, no expansion—						
¼-horse power...	234	0.51	15°	—18°	66	....
½-horse power...	241	0.61	50°	.....	....	47.3
1-horse power...	187	1.08	15°	—15°	55.1	....
1-horse power...	230	1.42	60°	23°	....	46.0
Rotary Cut-off—						
1-horse power...	221	1.24	16°	—36°	41.6	....
1-horse power...	207	1.18	15°	—42°	36.4	....
1-horse power...	210	1.20	70°	3°	....	27.2
2-horse power...	200	2.30	20°	—48°	30	...
2.horse power...	235	2.72	70°	.....	....	24
2 horse power...	241	3.22	60°	—2°	....	24

Without pre-heating, rotary motors with an automatic cut-off consumed 30 c. m. per hour per horse power. When the air is pre-heated to 50° C., the consumption declined to 24 c. m. The following table gives the comparative results of running small crank engines when using the air as it comes from the pipe line and after pre-heating it:

Efficiency of Small Crank Engines.

Engine.	Revolutions.	Horse Power at Brake.	Air Temperature. Admission.	Air Temperature. Exhaust.	Air Consumption per Horse Power per Hour. Without Heating. C. M.	Air Consumption per Horse Power per Hour. With Heating. C. M.
Two-horse power Tangye.....	242	3.77	25°	—37°	33.6	....
Two-horse power Tangye.....	229	3.56	150°	....	....	27.2
Two-horse power Journaux.....	169	2.10	10°	....	34.1	....
Two-horse power Journaux.....	148	2.27	150°	....	....	19.7
One-horse power Journaux.....	283	1.035	150°	34°	....	24.2
One-horse power Boulet	149	4.10	165°	18°	....	23.13

All of the engines experimented with above were old steam engines of poor workmanship. The friction was very great. Thus, the 2-horse power Journaux engine showed 67 to 75 per cent. With a better class of engine 90 to 92 per cent. efficiency has been proven. Even an old 80-horse power single cylinder Farcot steam engine used as an air engine developed an efficiency of 91 per cent. The following table gives the results of experiments with this engine, which had been working for six years as a steam engine, and was simply supplied with compressed air instead of steam, a heating oven being added, which was capable of carrying the temperature of the air to 170° C.:

Efficiency of 80-Horse Power Farcot Engine.

Revolutions.	Indicated Horse Power.	Air Temperature—Admission.	Air Temperature—Exhaust.	Air Consumption per Indicated Horse Power.
54.3	72.3	129°	21°	14.45 c.m.
54.3	72.3	152°	29°	13.45 "
54.0	72.3	160°	35°	13.16 "
40.0	65.0	170°	49°	13.50 "

Professor Reidler discusses in detail the advantages of the compressed air system, protests against any deductions unfavorable to it, like the Birmingham plant, and goes into a theoretical investigation of the loss due to transmission over long distances. In all the calculations of the Professor with the engine experimented with, the assumption was made that the loss in pressure was equal to one atmosphere in the Paris system. It was believed at first when designing the plant that reservoirs would be necessary to act as accumulators for the air. It was found. however, that the pipe lines themselves met all the requirements in this respect, and no provision will be made in the new system, which is to have a line of 500 mm. pipe, the old system having 17 km. of 300 mm. pipe. Elaborate tests were made to arrive at accurate data concerning the leakage and the friction in the pipes. So far as the former is concerned, the results have been that it amounts to only 5½ per cent. on the whole line of 17 km. Concerning the latter, one important consideration was brought up. It was soon discovered that the main pipe line, which was provided with a number of water reservoirs, whose resistance was exceptionally large, showed that as soon as the rate of flow of the air exceeded 7 m., there was a loss of pressure due to one of these reservoirs of 0.15 atmospheres, which increased to 0.2 atmospheres when the velocity rose to 9 m. Yet the friction due to these reservoirs is not normal, since other arrangements for draining the pipe might be provided which would not have the drawback referred to. In all tests the resistance of the large drainage reservoirs and of the large number of smaller siphons is included. In the whole line of 16.5 km., which includes the southern pipe line, starting from the central station at the Rue St. Fargeau to the Madeleine and through the southern pipe line, are four large drainage reservoirs with great resistance, and 23 siphons. The friction due to these apparatus is included in the resistance of the pipe line in general. The tests were repeated frequently, and included velocities up to 15 m. per second. The following table contains some of the results of the series made:

Friction in Compressed Air Pipe Line.

Line.	Length, Meters.	Initial Pressure, Atm.	Pressure at End, Atm.	Air per Hour, Cu. Meters.	Velocity, Meters.	Decrease in Pressure. Atmos. per Km.
Entire line.....	16,502	6.25	4.25	2206.0	8.67	0.12
" "	16,502	6.78	4.36	2100.0	8.24	0.14
" "	16,502	7.125	5.84	1485.0	5.83	0.07
" "	16,502	6.90	6.28	1060.0	4.10	0,03
" "	16,502	6.78	6.40	865.2	3.40	0.02
Usine II., Charonne	4,403	6.90	6.60	1297.0	5.09	0.07
" "	4,403	7.125	6.95	966.8	2.80	0.04
" "	4,403	5.78	6.17	1859.0	7.30	0.14
" "	4,403	7.125	6.70	1408.0	5.53	0.09
Fontaine Usine I...	3,340	6.00	5.84	1610.0	6.32	0.048
Charonne Fontaine.	8,759	6.65	6.39	1071.0	4.20	0.029
Fontaine Usine I...	3,340	6.33	6.29	1102.0	4.32	0.012
Usine Charonne....	4.403	6.75	6.50	1126.0	4.42	0.056
" "	4,403	6.37	6.20	1248.6	4.90	0.038

The conclusion is that for a velocity of 6.5 m. the loss of pressure of one atmosphere, which was assumed in all the discussions of efficiency, would permit of a length of line of 20 km., so that at the end of so long a line any motor driven by compressed air would show the consumption of air and the efficiency alluded to before. With an average velocity of 6 m. it was shown that in the Paris pipe line the reduction in pressure was 0.07 atmosphere per kilometer. Prof. Reidler believes that with a properly designed line the area of distribution might be increased to 20 km. radius for a loss of pressure of one atmosphere, and adds that a more thorough design might further improve the results of the system.

Commercial Rating of Electric Generators.

[A paper read by Mr. Thomas G. Grier before the Chicago Electric Club.]

Good engineering requires that specifications should have their aims, objects and purposes defined with accuracy. The generator of an electric light or power plant is one of its most essential features, and in defining or in rating its capacity we should do so in terms that have a tangible meaning.

The standard electrical units by which electric light installations may be specified are the ohm, volt, ampere and candle power, and in electrical power installations substituting the horse power for the candle power.

Instruments for measuring the ohm, volt and ampere have been adapted to the necessities of practical engineering, and when these three units are the basis of a specification it is with comparative ease that an expert can ascertain the correctness of the work.

In the majority of specifications and contracts, as now drawn, the capacity of the wiring will be for so many 16-candle power lamps, or for so many horse power motors; and the generators will be rated in so many 16-candle power lamp capacity, or for so many horse power motors.

This use of the units, candle power and horse power, virtually means nothing.

The arc lamp of so many nominal candle power is another unit which means nothing when applied to the capacity of the machine.

The candle power unit is in a measure open for criticism on the point of accuracy, but in the discussion the discrepancies that may exist in the several standards are not the points to be considered. The candle power unit is a unit of light. Our generators do not produce light, but electrical energy. Our arc and incandescent lamps convert the electrical energy into heat and light. The horse power is the unit of power. Our generators do not produce the power, but our motors utilize the electrical energy and convert it.

Before considering why we should not use the terms candle power and horse power in rating our generators, even though these terms are perfectly correct, we will discuss the converting apparatus, that is, the incandescent lamp, the arc lamp and the motor.

The incandescent lamp being an apparatus for converting electrical energy into light with an unfortunate side product of heat, does not give back 100 per cent. of the electrical energy as light, nor does the proportion that produces light and the proportion that develops heat vary in the same ratio under different conditions. Lamps are in use to day that vary in the consumption of energy per candle power produced from 3 to 7 watts, and even as low as 2 watts has been claimed. This variation in the energy, when the lamps are of the same voltage, means a variation in the amount of current necessary to produce the equal amount of light. Recent experiments made upon lamps bought in the open market show conclusively that lamps of the same rated voltage and candle power are not uniform. Here are a few instances of the variations of the amount of current required.

First, 20 lamps, 10 each of two different makes, were placed upon ordinary commercial meters, and were burned for the same length of time. To eliminate the errors of the meters they were transposed so that each set burned an equal time on each meter. The result of the experiment showed that there was a difference of 27 per cent., in the amount of current consumed, between the sets.

Second. Another station tried the same experiment using one set of lamps of a different make from that of the former, and one set of the same make. The result of their experiment was a difference of 22 per cent.

Third. A station operating some 700 lights had a number of the nominal 16-candle power lamps that were in use, tested, and found the can-

dle power to range from 17 to 22-candle power. On discovering this, nominal 10-candle power lamps were used and called 16-candle power. As the current was sold by meter, the customer was in no way injured by the substitution.

Fourth. A number of large lamps were tested, and nominal 100 candle power lamps were found to give from 44-candle power up to 110 candle power.

Fifth. In December, 1890, tests were made on four different makes of lamps. All the lamps were marked, by the manufacturers, at the same voltage, and all were nominal 16-candle power lamps. The tests showed a variety of candle powers ranging from 11 up to 24, and efficiencies from 2.46 watts to 4 watts per candle power.

Sixth. A large lamp of new make of nominal 150-candle power gave an efficiency of 2.4 watts per candle power. As this was the most efficient of any lamp tested it has been placed on the circuit of a central station, and is undergoing a life test.

These experiments are of considerable value in this paper as proofs of the desired end in view, as they show that when capacity is given in candle power it means only an approximation. We, however, should not draw conclusions as to the real commercial value of the lamps tested.

The durability of a lamp is a most important factor, and without a test as to the life of the various lamps and a mathematical equation being deduced that would include life, efficiency and cost of lamp, no actual commercial conclusion should be drawn. It is a well known fact that the life of a lamp is dependent upon the efficiency at which it is used. A lamp can be made to produce light commercially at an expenditure of energy varying from 2 to 7 watts per candle power.

The factors that govern the efficiency at which the lamp should be run are, the cost of producing the electrical energy, and the cost of the lamps.

From this view of the matter, even though the lamps were uniform, it is possible to have conditions wherein would exist a difference of over 100 per cent. to the amount of current necessary to produce equal amounts of light.

When a specification requires that an incandescent dynamo should have a capacity of 100 16-candle power lamps at 110 volts, what does it mean? Must the machine be capable of producing energy sufficient to operate lamps at 7 watts, or but 2 watts per candle power.

Must it develop 30 amperes, or about 102 amperes? Either machine being within the range of the specification, the efficiency of the lamps entirely governing the size. If nothing further than the capacity in candle power is specified what right would the purchaser have to grievance or redress if the machine of the smallest limit (that is 30 ampers) were sold to him as a 100 light machine, his lamps requiring more amperes than 30?

The arc lamp is also an apparatus which converts our electrical energy into light and heat. Its efficiency when well adjusted and carefully cared for, should not vary to any great extent. Bad adjustment is a baneful cause of poor efficiency, and good adjustment cannot be maintained without good regulation. To measure the candle power of an arc lamp is not the easiest matter in the world, and for one to attempt to judge by the eye is an absurdity.

In tests that have been made on arc lamps, the results were from $\frac{1}{16}$ of a horse up to 1 $\frac{4}{16}$ horse power per lamp of 2,000 candle power, so-called. These figures were based upon the difference between the total horse power exerted by the engine, and the horse power of the engine running empty and the belt thrown off the dynamo.

As the actual candle power of the lamp could not be measured it remains still a matter of conjecture whether the machines were really of so many 2,000 candle power lamp capacity.

The motor is another apparatus for transforming electrical energy into different forms. The efficiencies of the various motors on the market vary from 90 odd per cent. to as low as 50 per cent., and perhaps lower. Their efficiency also varies with their speed and load.

The generator of a 10-horse power motor could mean a machine capable of generating anywhere from 11-horse power up to 20, depending entirely upon the economy with which the electric motor would utilize the energy supplied by the generator.

The question of rating the machines in the units which measure the work of another piece of apparatus is merely rating the machine upon a variable standard, that is, the efficiency of another machine. We do not rate our engines in the capacity of the dynamo, but upon a unit of its own—the horse power, giving the speed and pressure at which this horse power is developed.

The boilers, however, are frequently rated in the unit horse power, which unfortunately is as great a mistake as the rating of dynamos or generators in any other unit than that of the form of energy which is directly produced by them. The transformation, or the conversion, of any form of energy to another must take into consideration the efficiency of the converting apparatus.

In transmitting energy from the point of production to the point of consumption, a loss is entailed. To convey electrical energy for light and power we use a metal conductor. The size of this conductor is not dependent upon the amount of horse power developed or the amount of candle power developed, but upon the amount of current transmitted, and the amount of pressure behind it. It is within the limits of possibilities wherein the current to develop the same amount of light or power may be double in one case what it would in another, owing to the difference in efficiency of the converting apparatus.

Another point to consider besides the efficiency is the resistance in the conductors. In some cases where fuel is extremely cheap, a large percentage of the energy may be used in transmitting the power, and consequently the generator would have to have an increase added to its capacity in proportion to this percentage that is lost. Tables for the use of wiremen have been prepared by the various companies, and while speaking of the generator it is just as well that attention should be called to the tables. Units used as a basis for their determination are the horse power and the 16 candle power lamp. It is apparent that a wire to carry a 16-candle power lamp or a horse power with a certain per cent. loss, does not even mean an approximation, the variable conditions that exist giving the expression only a very general meaning. The lamps or horse power are assumed to take a certain amount of current, and, though the calculations are correct, the entire table depends for its accuracy upon how near the assumption approaches the actual efficiency of the apparatus used.

The capacity of the generators should be specified in the units that measure the energy in the form in which it is developed. Dynamo electric machines develop or produce electrical energy measured in volts and amperes. The carrying capacity of wires for the transmission of this energy depends upon volts and amperes. The candle power and horse power have naught to do with it. Electrical generators should have their capacity specified in volts and amperes or in watts giving the pressure in volts at which this specified power is produced. The size of the wires should be determined upon the basis of amperes and volts, stating the percentage or number of volts lost in transmitting the current.

The English manufacturers give the capacity of the dynamo in watts, and a purchaser, even if he be ignorant of the first principles of electrical machinery, could, with little trouble, find whether he had received the capacity that he had paid for. But had the rating been in candle power or horse power the result could not have been so satisfactory.

The Edison Company in the United States and several others of the larger electric manufacturing companies have given the capacity of their various generators in watts, but the agents and contractors seem invariably to overlook this, and propositions and contracts are drawn up with the generators rated in the indefinite terms, horse power and lamps or candle power.

Why the Americans have adopted the candle power and the horse power as a basis of rating electrical machinery and the compiling of wiring tables, is, perhaps, apparent to many; and the reasons were, no doubt, at one time good. It is, however, obvious that this general use of these technical terms is entirely wrong and the electrician must be the means of reorganizing the system. The tendencies are in the direction of this needed reformation, but the change cannot be too rapid nor too soon.

The fundamental principles of Ohm's law are thoroughly familiar to the intelligent workman, and the sooner our calculations are confined to its mathematical accuracy and our generating machinery rated in the proper units, the better for the electrical business.

Foundations for Heavy Buildings.

A contemporary (*The Architect*), in a very well-written article respecting the above-named division of modern buildings' construction, calls attention to the fact that loads are now put upon foundations which 30 years since would have been regarded as impracticable. Three tons per square foot of area was at one time regarded as a fair working load for concrete; now nine tons or more, is put upon the foundations of heavy railway works; and, in like manner, the loads are growing on the foundations of large city warehouses, railway depots, and buildings of similar classes.

It is not only, or even principally, by increasing the heights of buildings that the foundation loads are intensified, but also by increased floor areas and the wider spans given to windows and other openings. Al

these improvements on former arrangements tend to localize the loads, and therefore to bring very heavy pressures over comparatively small foundation surfaces; means must, therefore, be taken to compensate such unequal distribution of pressures. We may take an example to show how these loads amount up even in structures of medium size. Suppose we have a storage warehouse for heavy merchandise, with four floors above the ground floor, and each floor 20 feet wide in the direction of its joists. Half the load on each floor will pass to each of the side walls carrying the joists. We will, for the present, assume that these walls have no windows or other openings, so that half the load will be equally distributed along the length of the foundation of each wall. It will be convenient, for purposes of calculation, to take one foot length of foundation and determine the load upon it. Two and a half hundredweight per superficial foot will certainly not be excessive to assume as maximum floor load, including the weight of the floor itself; then as there are four floors above the ground, the total load per foot of wall due to these will be 2.5 cwt. × 10 feet × 4 = 100 cwt. The roof principles, covering, and effect of wind and snow may be taken as ¾ cwt. per superficial foot; this will add to the load 10 × 0.75 = 7.5 cwt. There now remains the weight of the wall itself to be taken. Taking the top wall as 1½ bricks thick, and increasing in thickness half a brick for each floor, the mean thickness will be 22½ inches. Sound brickwork weighs about a hundredweight per cubic foot; so, allowing the wall to be 50 feet high, the weight of wall per foot run will be 50 feet × 1.875 × 1 cwt. = 93.75 cwt. The total load per lineal foot will, therefore, be 100 + 7.5 + 93.75 = 201.25 cwt. at the base of the wall. At this point the wall will be 31½ inches thick; therefore, the load per superficial foot will be 77 cwt. nearly, or 3 tons 17 cwt. Of course this may be reduced by offsetting the footings; but that may be a point for subsequent remark. That this is only a medium case is shown by the fact that there are plenty of city warehouses which run up to five stories, and then have a basement and sub-basement beneath, making in all seven floors to be supported.

The inconveniences of ascent in high buildings being practically abolished by the adoption of lifts, the only limit to their altitude will be that imposed by municipal restrictions, while other extensions increasing the foundation loads are not interfered with. If, instead of being dead walls, the side walls above referred to were perforated to form doorways for the admission of goods or for other purposes, then the distribution of the load would no longer be uniform, that part of it over any opening being necessarily transferred to each side of it. If one-quarter of the length of the wall were thus removed by openings being made in it, the load on the remaining part would be increased to 87 cwt., or 4 tons 7 cwt. per superficial foot of wall base. To obviate this it would be better not to let the loads over the openings so distribute themselves in the foundation walls, but to take them upon piers or pilasters built on each side of each opening. These piers will prevent racking strains in the vertically continuous parts of the wall, and their weight may be taken as balancing that removed to form the openings. In the above load, 4 tons 7 cwt., allowance for removed brickwork has been made on the assumption that each opening is 6 feet in height. The actual directions of the thrusts upon a wall carrying localized loads cannot be determined, and probably will differ in each particular case according to the workmanship exhibited in the bricklaying, the uniformity of size and hardness of bricks, and the age of the work. If the openings are spanned by arches, then, while the mortar remains unset, there will be more or less inclined thrusts acting in the walls, together with the vertical thrusts due to direct load. When, however, the whole work is set, if, as is frequently the case, the spandrel wall is much deeper than the arch, it is most probable that no thrust will accrue from the latter, but that the weights of the parts over the openings will be transmitted to the piers or intervening walls by direct lateral adhesion throughout the height of such spandrel walls. That this is generally the case is shown by the fact that holes may be made in old walls which are sound without fear of the upper part falling out, so long as the widths of such holes do not exceed certain limits in relation to the height of the wall operated on. Accepting this as the actual condition of things, it is evident that the use of piers is the correct course to adopt to take the localized stress at once to the bottom on a horizontal area that will reduce the load per superficial foot to that on the remaining part of the wall; by this means the vertical thrust being rendered uniform any tendency to split the foundation walls by unequal settlement will be avoided. When the loads over the openings are carried by girders the load will from the first be transmitted vertically to the piers, and this is a point in favor of using girders in preference to arches, because in that case the same class of strain that is set up in the first instance is continued, and never varies in direction as the work ages. Hence, if the work does not show signs of unequal settlement in a comparatively short time it is not probable that it will ever do so, except it be from some cause altering the condition of the natural foundation upon which the fabric is raised.

The object of offsetting the footings being to reduce the intensity of load upon the bed beneath the wall, it is very necessary that the offsets shall be sufficiently strongly fixed to the wall to distribute its weight without yielding. It is obvious that for this purpose recessed bricks should in no case be used, because if they are there is but a very small part of their length in contact with the outer edge of the thin mortar joint with the course above and below, and the mortar in the recess not being confined by the surrounding edges of the brick will most likely squeeze out, and so lead to a very irregular distribution of load. There is no doubt that to be satisfactory in all respects the footings should be made of flagstone, but, of course, the question of expense enters here, though in such a case good work should be the first consideration. If the stone cannot be had the brickwork footings will rest directly on concrete, which should be very carefully mixed and laid. This part of the work requires very close attention on the part of the clerk of the works, for there are many causes which may render concrete anything but homogeneous, and if this is full of inequalities of strength and solidity it will give the brickwork above a very poor chance. Under heavy loads it is also of great importance to keep the joints as true as possible to secure the greatest compactness.

Where the loads are still more localized by the structural arrangement consisting largely of floor girders of considerable span, it is best to relieve the foundations of the walls entirely of the floor loads, and let them carry only their own weight and that of the roof. The ends of the girders are then supported upon columns of cast iron, which may stand beside or in pockets in the walls, but independent of them and on independent foundations. These foundations must be proportionately massive, and should be made of stone bedded in concrete, the greatest care being taken in working the stones of the beds to make them true, any deviation from this course being almost sure to lead to their splitting when the full load comes upon them.

The French Commission on Gas Manufacture.

The London *Journal* says that about a twelvemonth ago the French Minister of the Interior, acting under the powers vested in him by the 48th article of the Treaty entered into between the Paris Gas Company and the City authorities in 1870, nominated a Commission to investigate any new process in connection with gas manufacture, introduced during the five years from 1885 to 1890, which could legitimately be said to constitute an improvement likely to effect a notable reduction in the net cost of gas, and to indicate such improvement to the Administration, with the object, if it had not already been brought into use by the Company, of enjoining it upon them for the benefit of the consumers. The investigation extended practically over the year; the result being the presentation of a voluminous report.

The Commission was nominated on Jan. 31 last year—the members being MM. Bochet, Cornuault, Lippmann, De Luynes, Potier, and Vieille; and a preliminary meeting was held at the Hotel de Ville, Paris, on the 28th of the following month. The members were received by M. Alphand, Director of Works, as representative of the Prefect of the Seine, who explained to them the nature of the inquiry they were to undertake. Being asked to specify the "new processes" which the Administration wished the Commission to investigate, he replied that they knew of nothing to which to call special attention. Thereupon M. Alphand retired; and the Commissioners proceeded to business. They first elected M. Bochet their President (M. Potier to act in this capacity in his absence): and next appointed M. Cornuault as Secretary. Views were then exchanged as to future proceedings; and, in order to have a definite basis on which to commence, the Secretary was instructed to prepare a *resume* of the knowledge on the question—the Commissioners' intention being to investigate all the new processes, improvements, etc., connected with gas manufacture, which could be brought before them, whether or not they had been adopted by the Paris Gas Company. The next meeting was held on the 15th of March. In accordance with his instructions, M. Cornuault prepared and presented a summary of the work of the preceeding Commission, whose investigations embraced the period from 1880 to 1885; and the Commissioners decided to conduct their inquiry on similar lines—to call before them expert witnesses and visit gas works. The persons whose positions seem to mark them as specially capable of assisting the Commissioners were the President of the Societe Technique du Gaz en France (M. Le Treust), the managers of various gas companies—French, English and German—and inventors of gas appliances. M. Raoul Duval, Chairman of the Paris Gas Com-

pany, and M. Godot, Deputy Superintendent, representing M. Camus, the General Superintendent, were introduced, and, in reply to the President, stated that the Company had not adopted any new manufacturing processes, and that the alterations which had been made in the plant and works could in no respect be regarded as inventions or improvements in the sense indicated in the article of the Treaty under which the inquiry was being held. M. Duval described the process of gas manufacture in its various stages, and gave further explanations in answer to questions put by the members of the Commission. This brought the sitting to a close; but before the adjournment it was decided to commence the visits to works on the 2d of the following month—beginning with the Villette station of the Paris Gas Company. Accordingly, the members assembled at those works on the day named, accompanied by M. Huet, Sub-Director of Public works, who represented the city. They were met by M. Duval and several of the Company's officials, one of whom (M. Godot) explained the general arrangement of the station. Commencing with the experimental works, which are under the direction of M. Sainte Claire Deville, a thorough investigation took place of the various processes of testing coal, analyzing gas, etc., carried on there. The ordinary gas making plant was then examined; and the visit closed with an inspection of the coal and coke stores, station meters, gasholders, and valve house. The next meeting was held on the 12th of of April, when M. Le Treust, Superintendent of the Amiens Gas Works, was in attendance. Questioned by the President as to any processes foreign to the present system of gas manufacture which have been introduced during the past five years, he replied that, as far as he was aware there were none in existence. With regard to improvements, he thought he could best indicate these by offering a few general remarks on the various manufacturing appliances. Dealing first with the handling of the raw material, he pointed out the different improvements which had been made; but these could not, he said, be regarded as new processes of manufacture. Distillation was still effected in clay retorts, charged mainly in the old way by the scoop and shovel, although M. Andre Coze had endeavored to simplify the work by constructing settings of inclined retorts to be filled mechnically. Passing on to discuss the subject of heating the retorts, he said he had unhesitatingly come to the conclusion that the adoption of regenerative furnaces had not resulted in any great economy in the cost of manufacturing gas. In the operations of condensation and purification, certain changes had been introduced; but they had not modified to any appreciable extent the expense attending this branch of the work.

With regard to the Dinsmore process, M. Le Treust considered it to be too complicated to revolutionize the gas industry, and he believed it would meet the same fate as its predecessors. In conclusion, he directed the attention of the Commissioners to the very important part played by the price of raw material in connection with the net cost of gas. He pointed out that in looking merely at the manufacturing operations, only the smallest side of the question was regarded, inasmuch as the cost of coal and labor, which is altogether beyond the control of gas companies, amounts to something like 80 per cent. of the total outlay necessary for the production of a given quantity of gas.

After M. Le Treust came M. Ancel, Manager of the Lyons Gas Works. He said he did not know of any process of gas manufacture foreign to the system actually employed by the Paris Gas Company. He gave particulars as to the consumption of coke in regenerator and ordinary furnaces, and discussed the advantages and inconveniences of the two systems. He dwelt upon the importance of a good system of distribution—having all the mains sound and the joints staunch. In his opinion, the methods employed by companies for disseminating knowledge as to the numerous applications of gas, and the sacrifices they have made in order to bring it within the reach of the smallest consumers, constitute the greatest progress that has been made in connection with the gas industry for some years past. The prosperity of gas companies should not, he thought, be attributed to a reduction in the net cost of production resulting from the adoption of new manufacturing processes. It was due, in a great measure, to the progress made in the commercial part of the undertaking—in other words, to the development of gas consumption. At the close of M. Ancel's remarks the Commission adjourned to the 26th of April, when they paid a visit to the Clichy works of the Paris Gas Company.

The inquiry was resumed on the 3d of May, the entire sitting being occupied in hearing from M. Coze a description of his system of inclined retorts, as in operation at Rheims and elsewhere. He claimed that its adoption would result in a saving of 50 per cent. for labor; and he produced some statistics, extracted from the books of the Rheims Gas Company, to show that, comparing two settings of nine retorts—one on the inclined and the other on the horizontal system—there was a greater weight of coal carbonized (to the extent of about 3¾ tons) and a larger yield of gas per 24 hours, coupled with more work done by the men, with the former than with the latter. It had, he said, been objected that the system was costly to introduce. In disproof of this, he submitted an estimate for a bench of six settings of nine retorts, placed back to back, the total being 64,616 frs. (£2,584), exclusive of royalty. He thought these figures would show that settings of retorts on his system were not more costly than those on the horizontal plan; and they might, in fact, be regarded as more economical, if account were taken of their higher production.

After M. Coze had retired, the Commissioners decided to visit the gas works at Rheims. The next meeting was on the 13th of May, when M. Alavoine, Manager of the Beauvais Gas Works, attended, and described the improvements effected in his hydraulic main furnished with strainers for separating the tar and ammoniacal liquor. The appliance was tried by the Paris Gas Company at their Boulogne works in 1885, and although they found, like M. Alavoine, that there was a rapid condensation of the tar, there was also (owing possibly to the different conditions of working) a diminution in the illuminating power of the gas, and trouble from the deposition of naphaline the moment the gas was cooled down to the outside temperature. M. Alavoine admitted that the appliance would not reduce manufacturing expenses to any considerable extent; its recommendation was rather on the score of convenience. At the same time he believed some economy in the cost of condensation and purification might be effected by its use. M. Alavoine was followed by M. Melon, Manager of the Lille Gas Works, who reviewed the various phases of gas manufacture, and said he did not know of any new systems apart from those adopted by the Paris Gas Company. He criticized the Coze arrangement and the Dinsmore process, and concluded by saying that in large gas works, furnished with plant which has been recognized during the past twenty years as the most suitable, the technical improvements possible would have no appreciable effect on the net cost of gas, which varies notably with an increase in the day consumption, and depends essentially on the price of coal and residual products.

The next four meetings were devoted to visits to Rheims, the Paris Gas Company's station at Le Landy, one of the gas works (No. 4) of the Berlin Municipality, and the Erdberg station of the Imperial Continental Gas Association in Vienna. On July 26 further evidence was taken. M. Emile Coze pointed out the changes he had made since 1885 in his method of hot condensation; M. Riboulet laid before the Commission his views on gas manufacture, the abolition of retort settings, etc.; and M. Jouanne, the agent in France for the Dinsmore Company, described their process, and explained what had been already effected therewith in England, and what was about to be done in France. At the next meeting, which took place on the 2d of August, the Commissioners reviewed their labors up to date, and came to the conclusion that they had heard and seen sufficient to enable them to consider their report; and M. Cornuault was entrusted with its preparation. In the meantime, Mr. H. M'Lauchlan Backler, Chairman of the European Gas Company, submitted for the consideration of the Commission a few observations on the position of gas manufacture in England. He remarked that, although the considerable rise which has taken place in the cost of coal and labor, coupled with the competition of the electric light, is a powerful incentive to English gas managers to endeavor to find some means of producing gas at a lower price than formerly, the actual progress made has, he regretted to say, been very slight, if indeed there has been any. He referred to the Coze system, and to the arrangement of inclined retorts with division plate devised by Mr. G. C. Trewby, as steps in advance; but he pointed out that they involve a reconstruction of the existing settings, and also the delivery of the coal at a higher elevation than is now customary. He acknowledged that the system might, in the future, render strikes of stokers less disastrous for gas companies than they are at present. The other subjects touched by Mr. Backler were the Dinsmore process, the carburation of gas in bulk, regenerative furnaces, mechanical stoking, condensation and purification, and gasholder construction; but he was unable to say that any of them had been productive of definite economy in the net cost of making gas. In fact, as the result of skilful administration, and careful supervision in the matters of the purchase of raw material and of maintenance and repairs, gas was now made with the least possible expenditure. Signed statements, in support of the evidence given before the Commissioner, were sent in by M. Camus and M. Duval (on behalf of the Paris Gas Company), as well as by the various witnesses.

After a two month's interval, the Commissioners met on October 18th, when M. Cornuault submitted his draft report, which was discussed at two subsequent meetings, and finally adopted unanimously on the 20th of

November. To recapitulate the conclusions arrived at: The Commissioners expressed the opinion that the Coze system was the only new "process," in the terms of the article of the Treaty under which they had been acting, which was susceptible of practical application in connection with gas manufacture, although it had not been sanctioned by experience, except to a limited extent. They acknowledged that the adoption of the system would lighten the labor of the stokers, but they refrained from saying anything on the subject of its economy. The Paris Gas Company had already experimented with the system, but the Commissioners did not think the company could be ordered to adopt it permanently. They added, in conclusion, that a careful investigation of all the elements constituting the net price of gas showed clearly how largely the commercial question preponderates over that of manufacture; and that, in the present position of the gas industry, a notable diminution in the net cost of production must be influenced by causes quite apart from manufacturing processes.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Montreal Gas Company, it is said, will shortly place on the market some acres of the land owned in what is known as the Hochelaga district. The real estate speculators at any rate are clamoring for opportunity to bid on the property.

ON the first instant, the proprietors of the Seneca Falls and Waterloo (N. Y.) Gas Company gave notice that the gas rate would hereafter rule at $2 per 1,000 cubic feet.

MR. EDMUND CATHELS left Chicago, on January 31st, en route for Butte, Montana, where he is to act as Superintendent of the Butte Gas Light Company.

IN a recent issue of the JOURNAL we said that Mr. B. E. Chollar was about to take an important position with the Laclede Gas Light Company, of St. Louis, and to that we may now add that Mr. Chollar has been appointed Superintendent of Station A. (formerly the old St. Louis gas works) of the Laclede Company, vice Mr. John B. Taylor, resigned. Before leaving Topeka, Mr. Chollar was presented with an elegant gold watch and chain, the watch bearing the following inscription, "To Mr. B. E. Chollar, from the Excelsior Gas Light and Coke Company, of Topeka, Kansas."

MR. TAYLOR'S resignation was a great surprise to all his friends, and is regretted by many. He had been connected with the old St. Louis Gas Company for over 25 years, and had been with the Laclede since the consolidation of the St. Louis companies.

A VERY pretty wedding was that which was celebrated, on the evening of Thursday, January 29th, in St. Andrew's Episcopal Church, in this city, the ceremonies marking the marriage of Miss Francis A Clarke and Paul Sabbaton Merrifield. The groom is a graduate of the Rensselaer Polytechnic Institute, of Troy, N. Y., and was for some time connected with the Troy Gas Light Company. He will, however, be best known to the fraternity from his present connection with the American Meter Company, for which he acts as Assistant Treasurer at the New York branch. May they ever happy be.

THE Central Ohio Natural Gas Company has notified its domestic consumers in Columbus that they will have to use the gas sparingly as the wells are holding out unmistakable signs of exhaustion.

AT the annual meeting of the San Diego (Cal.) Gas and Electric Light Company the following officers were chosen: Directors, W. W. Stewart, H. Bushyhead, R. H. Dalton, E. Westcott and R. M. Powers; President and General Manager, R. M. Powers; Secretary, F. W. Jackson; Superintendent, G. I. Kinney; Chief Engineer, R. S. Clarke.

IT appears that the bill introduced recently in the California Senate with the purpose of regulating gas and electric rates applies to the State as a whole, and not to San Francisco alone. It provides that the respective Boards of Supervisors are required, in February of each year, to establish rates to be charged by persons or corporations who have franchises to furnish electric or gas lighting, such rate to be in force one year. Boards of Supervisors refusing or neglecting to establish such rates may be compelled to do so by any electric or gas company having a franchise. The act also provides that in establishing rates the governing bodies of cities and towns shall not allow a greater sum per 1,000 cubic feet for furnishing gas, nor per burner for furnishing electricity than will give the company 6 per cent. per annum on the capital invested. The assessed value of the real or personal property used in the business for the year preceding that in which the rates are to be established on the highest market value of the capital stock on any day in January or February of the current year alone shall be taken as the value of the plant.

WE recently received the following communication, under date of 2d inst., which explains itself: "The following contracts for new work for the coming season are among the orders recently received by the Manhattan Fire Brick Works, Mr. Adam Weber, proprietor:

10	benches	9's, Brooklyn (N. Y.) Gas Light Company.
16	"	6's, Buffalo (N. Y.) Mutual Gas Light Company.
10	"	6's, Williamsburgh (Brooklyn, N. Y.) Gas Light Co.
6	"	9's, Boston (Mass.) Gas Light Company.
12	"	6's, Citizens (Buffalo, N. Y.) Gas Light Company.
36	"	6's, Consolidated Gas Company, New York city.

Also, linings for Loomis water gas plant to be erected at Williamsburgh, N. Y., and linings for Lowe plant for the Spanish-American Light and Power Company, of Havana, Cuba."

WE are called upon to chronicle the death of Arthur R. Gates, of Hamilton, Ontario, in the 34th year of his age, after an illness of several months. Deceased was the son of Mr. F. W. Gates, the well-known President of the Hamilton (Ont.) Gas Light Company.

THE sympathy of the fraternity will go out to Mr. George G. Ramsdell, of Vincennes, Ind., on account of the death of his father, which occurred on January 18. Mr. Ramsdell's death was very sudden.

THE following figures respecting the cost of gas and electric lamps on the streets of Baltimore, for the years noted, will be found interesting:

Year.	Gas.	Electric Light.
1884.....	$135,667 98	$63,216 30
1885.....	120,543 42	78,575 00
1886.....	70,993 80	110,457 20
1887.....	80,440 30	107,087 80
1888.....	124,963 93	103,222 00
1889.....	124,181 59	98,352 10
1890.....	122,130 59	85,280 12

THE Inspector of Illuminating Oils for the city of Baltimore, Md., for the year ended December 31, 1890, reports that there has been a continued improvement in the quality of refined petroleum sold in the city, as evidenced by the fact that since his prior annual report only 5 per cent. of the samples inspected were as low as the standard fixed by law —120° F.—the range having been from 120° to 140°. In consequence, only 9 accidents occurred, as against 28 during the previous year.

As samples of what was to take place and that which did (or did not) take place, we present the following:

Extract from the St. Joseph (Mo.) *Daily Gazette*, Jan. 22, 1891: "The St. Joseph Light and Fuel Company will give an exhibition of illuminating gas at their office, 118 North Fifth street, from 8 to 9 o'clock P.M., showing the light and burners as they will actually appear when used in workshop, factory, store and dwelling. Everybody invited."

Extract from the St. Joseph (Mo.) *Daily Herald*, Jan. 23, 1891: "The exhibition of the lighting properties of the gas to be manufactured by the St. Joseph Light and Fuel Company, last night, was postponed because of a peculiar accident. Three small tanks of the gas were shipped from Chicago, and the only one tested was found to be all right. When the others were tapped it was discovered that their entire contents had leaked out. A large number of people went to the Company's offices last night to see the display, and were disappointed on learning the true state of facts. Another supply of gas will be secured at once, and an exhibition given in about ten days." Perhaps!

THE authorities of Kansas City, Mo., are agitating the subject of the appointment of an inspector of lights, whose term of office is to be at the pleasure of the Board of Public Works. The salary is to be $100 per month.

MR. HENRY H. HYDE, who has efficiently performed the duties of Superintendent of "Works No. 2," of the Cleveland (O.) Gas Light and Coke Company, for the past 2 years, resigned recently in order to take charge of the East Saginaw (Mich.) Company's plant. We regret to say that his brother—Mr. G. A. Hyde, Jr.—who had been in command at East Saginaw, was obliged to retire because of ill health.

THE new gas plant at Rapid City, N. D., will be in operation by April 1st.

AT the annual meeting of the Newburyport (Mass.) Gas and Electric Company, the following officers were chosen: President, Eben F. Stone; Treasurer, D. D. Tilton; Directors, Eben F. Stone, W. H. Swazey, Eben Sumner, L. B. Cushing, T. C. Simpson, William R. Johnson and A. C. Titcomb.

IT is possible that the works of the Livermore (Cal.) Gas Light Company will be shut down. The business was operated at a pronounced loss during the last twelvemonth.

MR. L. M. HALE has resigned the Superintendency of the Emlenton (Pa.) Natural Gas and Fuel Company. His successor is Mr. C. J. Crawford, late Register and Recorder of Venango county, Pa.

THE residents of Independence, Kas., have the belief that natural gas would be found in paying quantities in that section if a sensible method of boring were inaugurated, but they would rather that the town's funds were employed in the search than that the money should come from out their own pockets. The authorities were appealed to for a "donation" of $800, for the purpose specified, but it was eventually decided that such a "donation" could not be legally made. The project accordingly languishes.

RECENT advices from Litchfield, Ills., are to the effect that J. C. Edwards, proprietor of the local Phœnix Hotel, has filed papers in the Circuit Court for a damage suit in $5,000, against the Litchfield Oil, Gas and Fuel Company. He alleges that the obnoxious smell given off by the Company's gasholder prevents guests from stopping in his house.

RECENT sales in the stock of the Salem (Mass.) Gas Light Company show that security to be worth 105.

MR. W. S. COLE, Agent of the Municipal Gas Light Company, Rochester, N. Y., has published the following notice: "From February 1, 1891, our rates for gas to all consumers on the east side of Genessee river, both on and off the lines of competing mains, will be 60 cents per 1,000 cubic feet. We propose to lay from 10 to 20 miles of new mains this coming spring, commencing as soon as the weather will permit, and we are now ready to receive applications from residents of streets which have been discriminated against by the Citizens Gas Company. All consumers of gas are advised to defer the making of contracts until we are heard from further." The war is certainly "on."

THE Boston offices of the Davis & Farnum Manufacturing Company have been removed to the Vulcan Building, Room 18. The Vulcan Building is at No. 8 Oliver street, Boston.

THE proprietors of the Biddeford and Saco (Maine) Gas Light Company have determined to put up a new gasholder; and the determination was reached none too speedily.

THE plant of the Belfast (Me.) Company will be enlarged this spring. This accounts for the passing of the usual semi-annual dividend, as the proprietors voted to put the earnings into the extensions.

GAS is again being distributed in Spencer, Mass., which is pretty quick resumption. The works, especially the generating section, were badly damaged by the fire—reported in the JOURNAL—that occurred there some time ago, but the repairs were completed in seven days.

THE following figures respecting the gas send-out in Providence for the past four years are instructive:

Year.	Send-out.	Increase.
1887.....	383,096,000 cu. ft.	
1888.....	424,770,000 cu. ft.	41,674,000 cu. ft.
1889.....	457,807,000 "	33,037,000 "
1890	475,424,000 "	17,617,000 "

ON last Friday the State Board of Gas and Electric Light Commissioners opened the hearing, at Easthampton, Mass., on the petition of the Easthampton Gas Company for authority to engage in the business of generating and furnishing electricity for light and power. Last fall the Company secured by purchase a controlling interest in the local People's Electric Light Company, and it is now desired to consolidate the two enterprises.

AT a meeting of the Eastern division of the Globe Gas Light Company, held in Boston on January 28th, the following Directors were chosen: Francis W. Lawrence, Rufus S. Frost, Sumner B. Pearman, Albert D. Bosson, Eustace C. Fitz.

GENERAL HICKENLOOPER, on behalf of the Cincinnati Gas Light and Coke Company, advertises that proposals will be received until noon of Wednesday next, for material to be used and labor to be performed in the building of a holder tank (157 feet in diameter) on the site, southwest corner of Rose and Second streets, that city. Plans and specifications are on file at the main office of the Company, Fourth and Plum streets. The specifications call for: 9,000 yards of excavation; 5,000 yards back filling; 800 yards concreting; 700 yards sand; 850 cubic feet of stone coping; 825,000 front and paving bricks, also the mason work in laying same.

IT is reported that the incorporators of the Pickaway Electric Light and Power Company, of Circleville, O., have purchased the plant and franchises of the Circleville Gas Light and Coke Company. The authorities of the place are anxious to go into arc lighting on public account, and this consolidation will probably make the way clear for such a trial.

THE new rate for gas for fuel purposes at Michigan City, Ind., has taken strong hold on the public fancy, and orders for gas stoves—both heating and cooking—are coming in thick and fast. According to agreement, the Gas Company, up to March 1st, will make a special rebate on prices for gas stoves, the stoves to be delivered at any time after March 1st, to suit the convenience of purchasers. The city is growing rapidly, and the Gas Company is keeping up with the procession.

"I NOTE an item in last week's issue to the effect that the Brookline (Mass.) Gas and Electric Light Company had decided to remove its manufacturing plant to a site on the Charles river, consisting of three acres of land, a trifle back of Cambridge street, which has been in the Company's possession for some time. Although this on its face may seem a somewhat radical move, nevertheless it is quite in keeping with the careful and methodical management of the Company, the managers of which are not given to striding in the dark, nor of acting on impulse. This project has been agitated in a conservative way for several months—the purchase of the property so far in advance of the time when it would be actually needed is evidence of this—and so the conclusion was reached without hurry or bustle. This move, too, shows the solid advance that has been scored by the Company, in respect to both divisions of its business, nor can it be said that it has favored the electric portion of the supply at the expense or to the detriment of its gas business. The rates for an arc or incandescent service are kept at a remunerative point, and gas is put at a figure which, while reasonable, permits of an honest profit on its distribution. A portion of the new site is not the best possible for building purposes, but a 'sea wall' 500 feet in length, and plenty of piling, will give ample protection and sure foundations. The sea wall and piling are underway, and contractor John T. Scully is in charge of the former, which is a guarantee of good work. Roughly, I may say that the plans call for the construction of two-storied buildings—the first story to be of stone, the second of brick—for the housing of the gas and electric machinery and apparatus, the retort house to be 100 ft. by 80 ft., and that the holder capacity is to be not less than equal to the storing of 500,000 cubic feet. The coal sheds will be right on the river front, with a dimension of 200 by 50 feet, and to be equipped with a complete outfit of Hunt's improved automatic hoisting apparatus. In fact, every modern appliance for the manufacture, storage and distribution of gas will be found in and out of the works when the same shall have been completed—the understanding is that everything is to be in working order by Dec. 1, 1891. The electric plant provision is for the maintenance of 500 arc and 8,000 incandescent lamps, and the plant is to be of the best modern type. Perhaps I will be able at a later date to forward you a more extended description of the new Brookline works, but in any event the fraternity may take it for granted that these will do full justice to the proprietors, whose business teachings incline them to the belief that that which is worth doing at all is worth the most when it is well done.—OBSERVER."

THE proprietors of the Jamaica Plain (Mass.) Gas Light Company have voted to extend their mains to the adjoining community of West Roxbury, the work to be undertaken as soon as the frost is out of the ground.

THE new smelter building of the New Jersey Zinc and Iron Company, at Newark, N. J., is to be erected by the Berlin Iron Bridge Company, of East Berlin, Conn., from designs arranged by the Bridge

Company. The building is to be 52 feet in width by 216 feet in length, and will be entirely fireproof.

THE Marquette Heating and Lighting Company has been incorporated to furnish heat and light at La Salle, Ills. The organizers are Messrs. W. E. Berkenbeurl, J. E. Malone, N. Strauss, W. A. Locke and G. A. Wilson.

THE following letter explains itself :

OFFICE OF THE DALLAS CITY GAS LIGHT CO.,
DALLAS, TEX., January 29th, 1891.

To the Editor AMERICAN GAS LIGHT JOURNAL :

I inclose you list of Southern cities with the population thereof :

	Population 1890.	Population 1880.
New Orleans, La.	241,995	216,090
Louisville, Ky.	161,005	123,758
Richmond, Va.	80,838	63,600
Nashville, Tenn.	76,309	43,350
Atlanta, Ga.	65,514	37,409
Memphis, Tenn.	64,586	33,592
Charleston, S. C.	54,592	49,984
Savannah, Ga.	41,762	30,709
San Antonio, Tex.	38,681	20,550
Dallas, Tex.	38,140	10,358
Covington, Ky.	37,375	29,720
Norfolk, Va.	34,986	21,966
Augusta, Ga.	33,150	21,891
Mobile, Ala.	31,822	29,132
Galveston, Tex.	29,118	20,248
Chattanooga, Tenn.	29,109	12,892
Houston, Tex.	27,411	16,513
Birmingham, Ala.	26,241	3,086
Little Rock, Ark.	25,133	13,138
Petersburg, Va.	23,317	21,656
Macon, Ga.	22,699	12,749
Montgomery, Ala.	21,798	16,713
Knoxville, Tenn.	21,181	9,693
Fort Worth, Tex.	20,725	5,633
Key West, Fla.	17,679	9,908
Austin, Tex.	15,324	11,013
Waco, Tex.	14,425	7,795

As you perhaps understand, there is great rivalry between the Texas cities, and especially between Dallas and Fort Worth, which places are only 30 miles apart. Probably you have not noticed the real difference in size and importance between these two cities, hence I thought the figures would be interesting to you. Dallas has grown with great rapidity in the last 4 years, and the volume of the gas business done in a city is generally indicative of the size and importance of the city itself. In 1885 the annual sendout was 10,000,000 cubic feet, and this sendout was augmented, during the last 5 years, at an almost constant and even rate —except in the year 1889, when the large extensions in electric lighting in Dallas kept the output down to about the same as the year previous ; or, in other words, we gained nothing in that year. But when the people began to find that gas was here to stay, and that electric lights could not always be depended upon, the increase in the output was again manifested ; so that, from 10,000,000 in '85, the sendout in the year 1890 reached 40,000,000. At the close of the year '85, these works were running to full capacity, and from that time on the work of enlargement has had to be prosecuted continuously. The buildings remain the same as when originally planned, and all the new apparatus necessary for the increased output had to be crowded into them, except that one new 100,000 feet holder has been erected. Of course, street mains have been enlarged materially—in fact, from 6 to 12-inch, and all down the scale in proportion. The close of the year 1890 finds us again running every retort in the works, and with some of the mains still of insufficient caliber. Dallas shows its splendid growth and enterprise as much by its increased lighting business as in its increased population, and it stands today without a peer in the State of Texas—with a gas works having a maximum daily output of 280,000 cubic feet, and an electric lighting station, fully equipped and running to full capacity, of 1,500-horse power. I read in a recent JOURNAL that Fort Worth claims to have a gas plant valued at $500,000. As she is half-way behind us in population and commercial value in all ways, I presume she must be half-way behind us in the value of her works also. I do not know that these figures will be of any value to you, or of any interest either, consequently I send them to you, trusting you will take them for just what they are worth. Yours, etc., WILLIAM ENFIELD.

AT the annual meeting of the Pittsburgh (Pa.) Equitable Gas Company, the following officers were elected : President, Robert B. Brown ; Vice-President, James Hemphill ; Treasurer, Robert Miller ; Secretary, Wm. A. Alldred; Directors, A. F. Keating, George Trautman, Charles H. Zug, J. Stuart Brown, Frank B. Robinson and L. M. Morris.

THE Cincinnati Electric Light Company has ordered an advance in the rates charged for arc and incandescent lighting, the same to date from the 15th inst. The increase will possibly average 30 per cent.

THE Laclede Company has relinquished all rights under franchises of the city of St. Louis, numbered in the ordinances 11,358 and 13,495. The first was granted to Thomas Howard and others, in 1880, and the second was issued to the St. Louis Gas, Fuel and Power Company, in 1886. The Laclede will operate under the franchise already assumed, and its relinquishment of the two specified will release from the city treasury moneys deposited to insure the fulfillment of the promises of the original grantees.

THE entire property of the Americus (Ga.) Light and Power Company is to be sold at auction in that city on the last day of the month. The proceedings are under foreclosure sale, and the property is mortgaged for $60,000. The electric lighting division of the plant is in good order, but the same cannot be said for the gas works end.

ON January 8, 1890, Messrs. A. C. Swain and V. M. C. Silva were granted a franchise for a gas works in Provo City, Utah. They did not comply with the terms of the agreement, and on January 21, 1891, the franchise was declared forfeited.

AT the annual meeting of the Davenport (Iowa) Gas Light Company the following officers were elected : President, J. J. Richardson ; General Manager, Thomas G. Gaylord ; Secretary and Treasurer, Nathan G. Pendleton ; Directors, Eliot H. Pendleton, Thomas G. Gaylord, J. J. Richardson, W. C. Putnam and Nathan G. Pendleton.

AT the annual meeting of the stockholders in the Grand Rapids (Mich.) Gas Company, the old Board of officers—including, of course, that sterling gas man, Mr. Thomas D. Gilbert—was re-elected. The usual quarterly dividend of 2½ per cent. was declared, and the Company's outlook never was brighter. The following excerpts are from the report of the Board of Directors : "The business of the past year has exceeded our expectations, and in pursuance of the traditions of the Company to share with its customers the results of increasing business we have made such an important reduction in the price of gas for 1891 as to place the Company in the front rank of those that are trying to furnish a good and cheap light. * * * There is not a city in the United States similarly situated with reference to the cost of obtaining the raw material, that is supplied with light for public and private use as cheaply as Grand Rapids. * * * Under the stimulus of the late reduction in price the use of gas is rapidly increasing, and there has been an unusual winter demand for stoves for cooking and heating by gas. * * * The Company has largely increased its producing capacity, and contemplates laying a large amount of pipe the ensuing season in parts of the city not now supplied with gas."

WE are indebted to a San Francisco correspondent for the following : "The annual meeting of the San Francisco Gas Light Company was held at the appointed time, and the report of the President-Engineer (Mr. Crockett) was well qualified to please the shareholders. His statement showed that contracts have been made for coal by which their supply averaged less than $7 per ton, while other large consumers had to pay from $9 to $11 per ton ; that to provide against the contingency of a coal famine an increased quantity of hydrogen gas had been manufactured, whereby 12,000 tons of coal had been saved ; that 15,000 tons of coal were now on hand, as against 11,000 tons a year ago, and that there were outstanding contracts for 27,000 tons, to be delivered on or before October 1st next. The sale of gas during 1890 exceeded that of the previous year by 24,760,000 feet an increase of 3½ per cent., and there had been a net gain during the twelvemonth of 1,435 new consumers. Reference was made to the purchase of a tract of land at North Point, upon which the Directors recommend the immediate erection of a water gas plant. Plans have already been adopted for the works, and as soon as they have been completed the Howard street works will be dismantled and sold. Secretary's Barrett's report showed total assets amounting to $7,289,856 ; liabilities, $96,747 ; net assets, $7,193,109. The pay roll for the year amounted to $490,843, a saving of $10,000 over the previous year. Twelve monthly dividends of 30 cents per share had been paid during the same period.

After the reading of the reports, the old Board was re-elected, as follows : Adam Grant, Joseph B. Crockett, Levi Strauss, George W. Prescott, Daniel T. Murphy, Christian de Guigne and J. Downey Harvey. The Board afterward organized by the election of J. B. Crockett as President and W. G. Barrett as Secretary.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, FEBRUARY 9, 1891.

The Market for Gas Securities.

The city gas share market presented nothing of especial importance during the week, although there was unmistakable tendency towards higher prices, particularly in respect to Consolidated which sold up to 97¾. The trading, however, was light, but that is not remarkable now. The truth is that the floating stock has been pretty well absorbed by investors, and the market depends greatly for its supply of "transient shares" on those who may be denominated weak holders. Two years ago we called attention to the fact that fairly large blocks of Consolidated were held in the permanent investment assets of many of our large insurance, trust and other financial concerns, the peculiarities of whose business require the safe placing at interest of large sums of money. Again, we call attention to this circumstance, brought vividly anew to notice through the late published reports of the standing of those institutions. The investments in this direction during the past two years have been increasing, and show that professional investors hold a high opinion of the shares. We renew our advice to buy Consolidated. It is as good as gold. The opening quotation in it to-day (Friday) was 97. At auction this week 5 shares Consolidated brought 97¾. Equitable moved up a trifle, and Mutual, although neglected, was strong. Standard does not seem to make much headway, but better things are likely to come out of it than current figures indicate.

Brooklyn stocks are strong all-round—200 Williamsburgh were disposed of at auction this week, at 131, and $5,000 bonds in same Company brought 110. Bay State, of Boston, is at 61¼ to 63, despite the petition shortly to come before the State Commission asking that the selling rate for gas in that city be reduced to $1.00 per 1,000. We think it is a purchase, and that it will carry a dividend before the year is out. Chicago gas is at 41¼ to 41½, and Laclede common is offered at 18¾, bidders at 18 being in plenty. Consolidated, of Baltimore, is somewhat stronger, at 47¾ to 48, and it is barely possible that an important move will be made in it soon. There seems to be some trouble on "the inside" in the management of the Mutual Fuel Gas Company, of Chicago, Messrs. H. N. Higginbotham and E. G. Keith having refused a re-election to the management, at the annual meeting held last Tuesday. The gas war at Rochester, N. Y., is, to those not interested, an amusing affair. If the cause of the hostilities ever comes to test before a court, contemporaneous gas literature will certainly be enriched by a most entertaining chapter. Why people should cut their noses for the sake of the pain that the operation naturally must give rise to can only be explained under one theory. Merciful time, however, will heal the wound, although the scar thereof must remain.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

FEBRUARY 9.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	97	—
Central	500,000	50	—	85
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	114	116
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	116	120
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	116	118
Citizens	1,200,000	20	85	90
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	130	132
" Bonds	300,000		10-	105
Peoples	1,000,000	10	90	92
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	103	105
Nassau	1,000,000	25	130	—
" Ctfs	700,000	1000	95	100
Williamsburgh	1,000,000	50	130	132
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	—	87
2d " " "	3,000,000	1000	—	75
Bay State Gas Co.—				
Stock	5,000,000	50	61¼	63
Income Bonds	2,000,000	1000	95½	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Company.	25,000,000	100	41¼	41½
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	84¾	85½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	98
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	94	98½
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	6,500,000	100	204	205
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			92	100
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	47¾	48
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	165	170
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	18½	18¾
Preferred "	2,500,000	100	55	61
Bonds	9,034,400	1000	81½	81¾
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			34½	35½
Peoples, Jersey City		—	60	61
" " Bonds			—	—
Paterson, N. J		25	99	102
Rochester, N. Y		50	99	100
Syracuse, N. Y	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	58½	59
Washington, D. C	2,000,000	20	200	208
Wilmington, Del.		50	88	90

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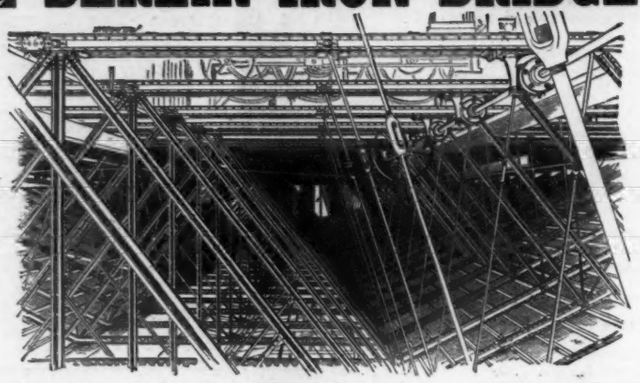

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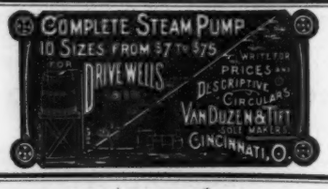

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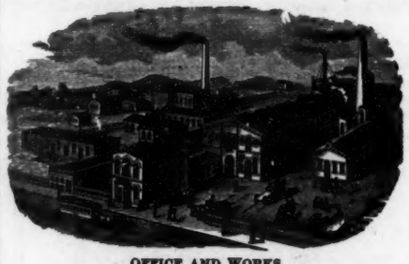

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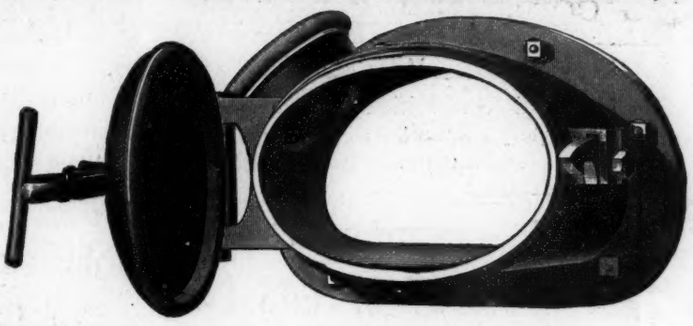

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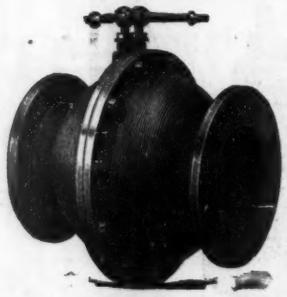

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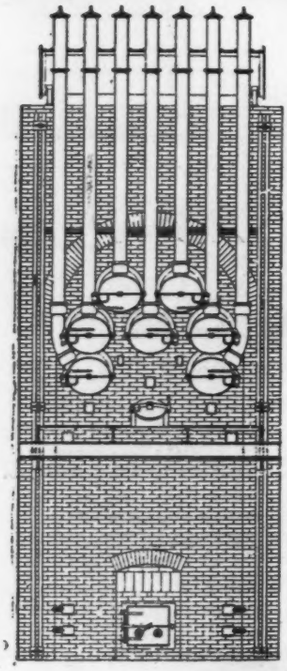

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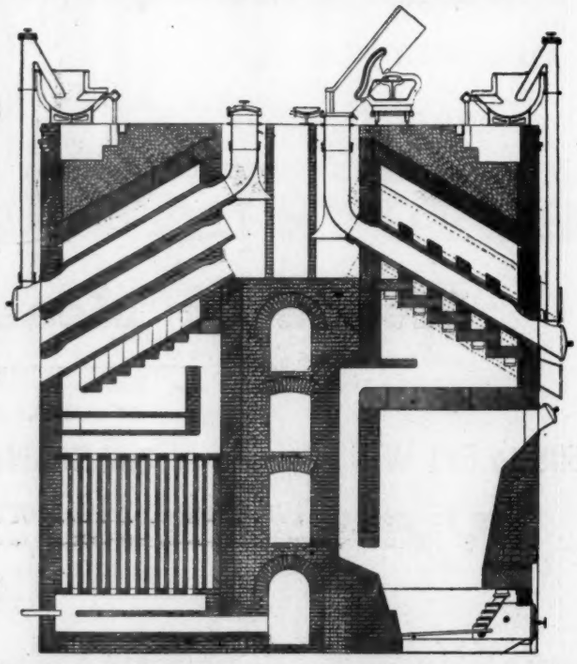

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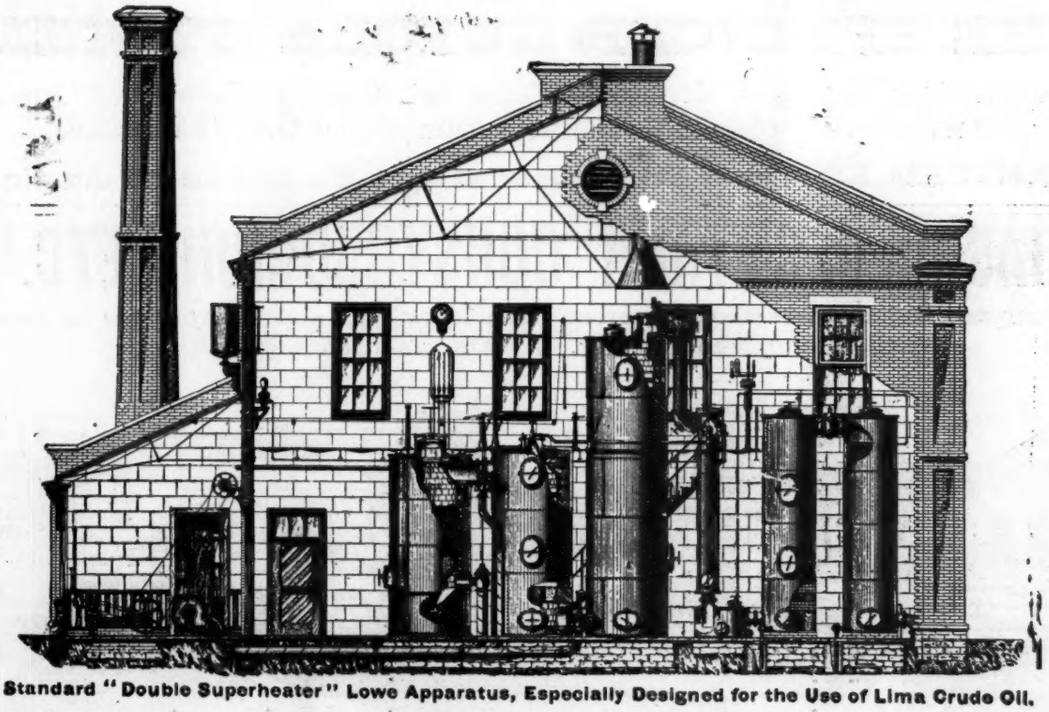

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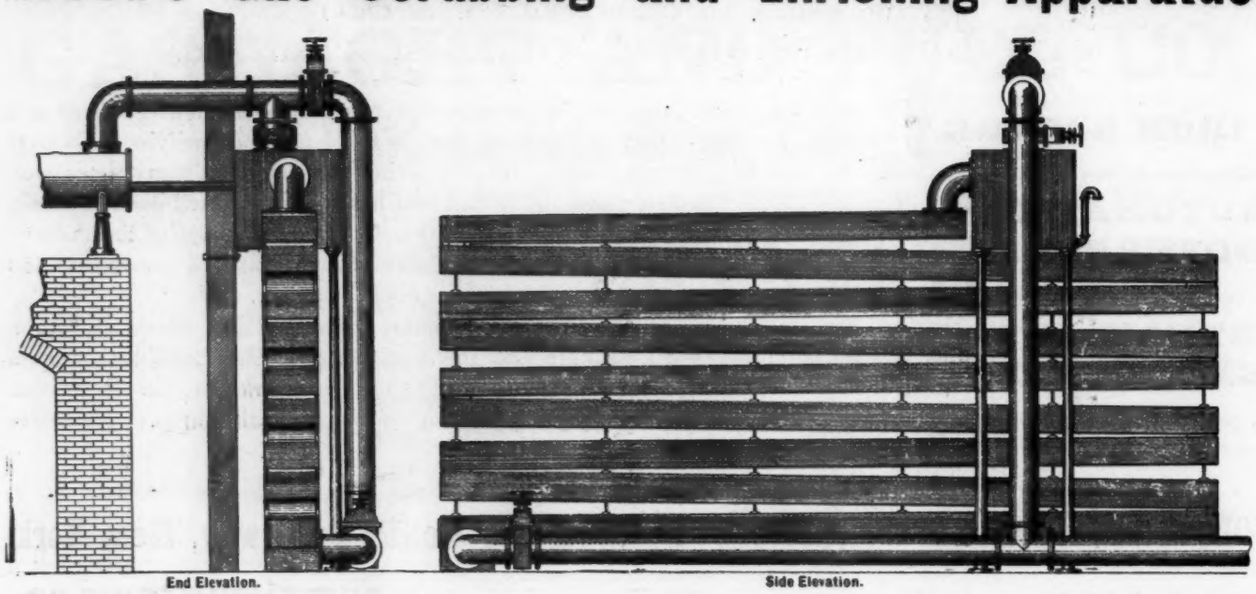

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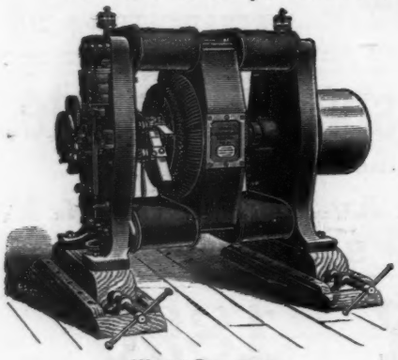

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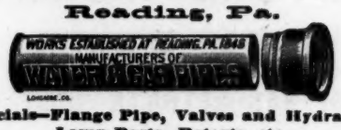

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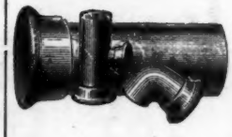

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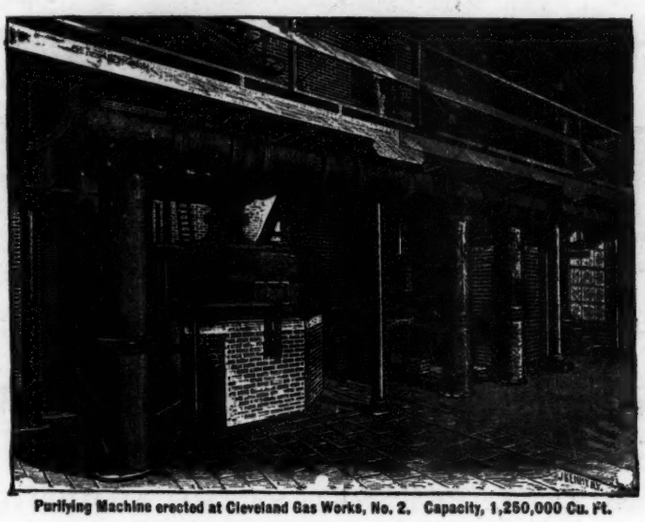

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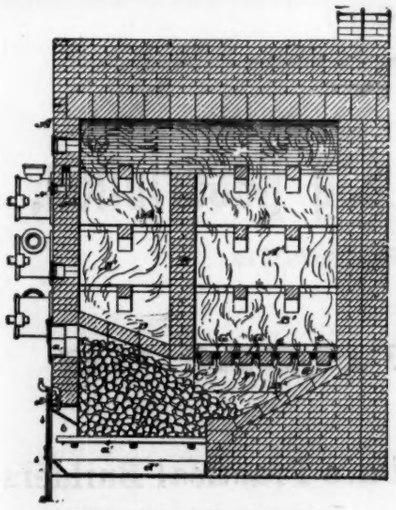

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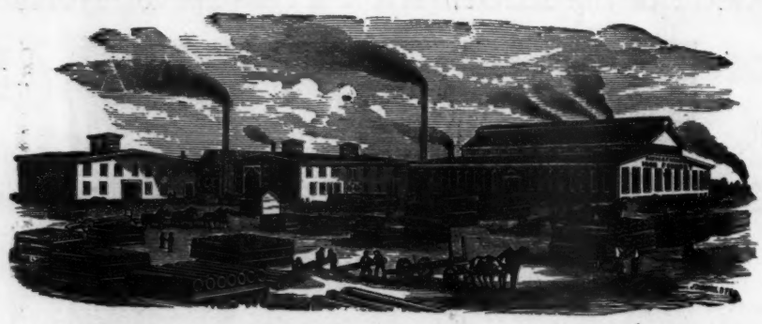

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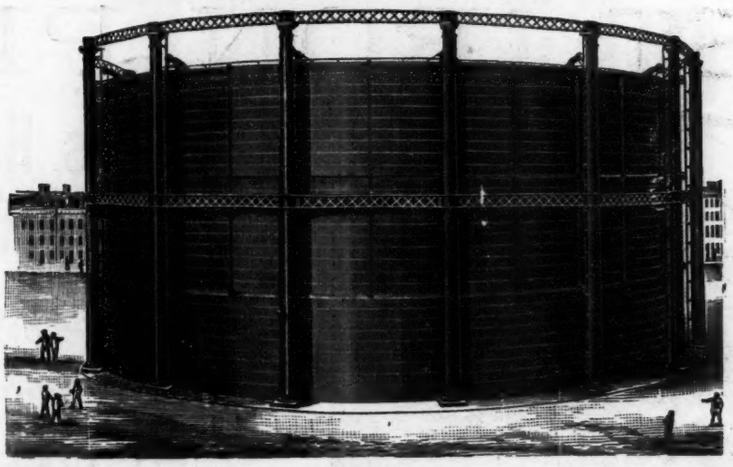

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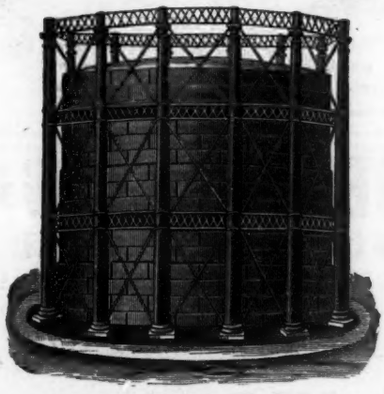

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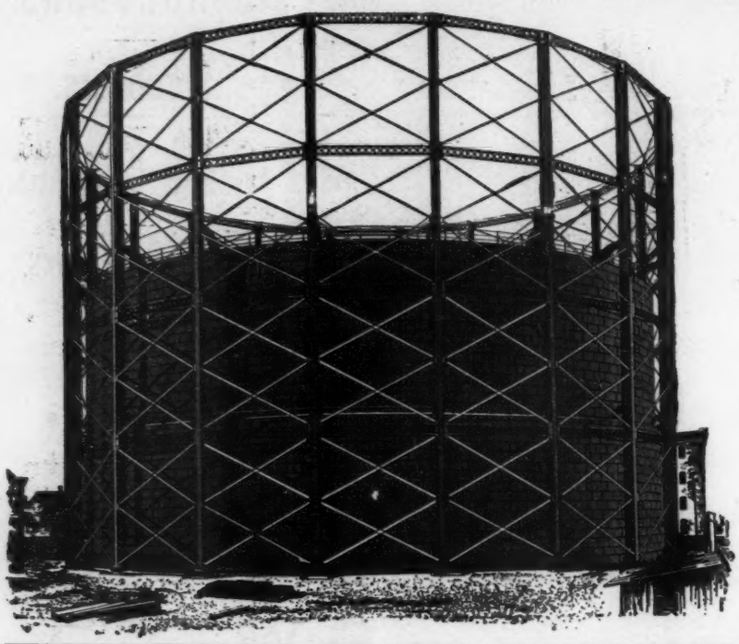

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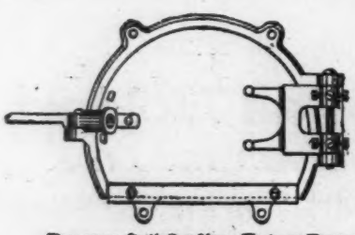

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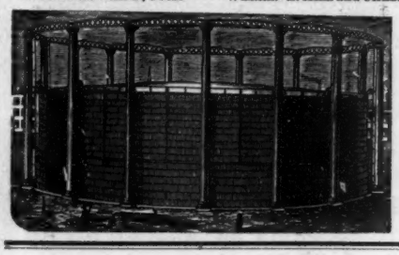
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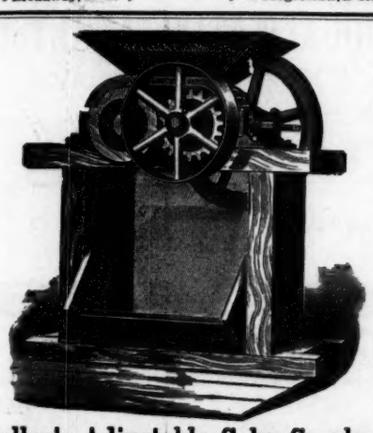

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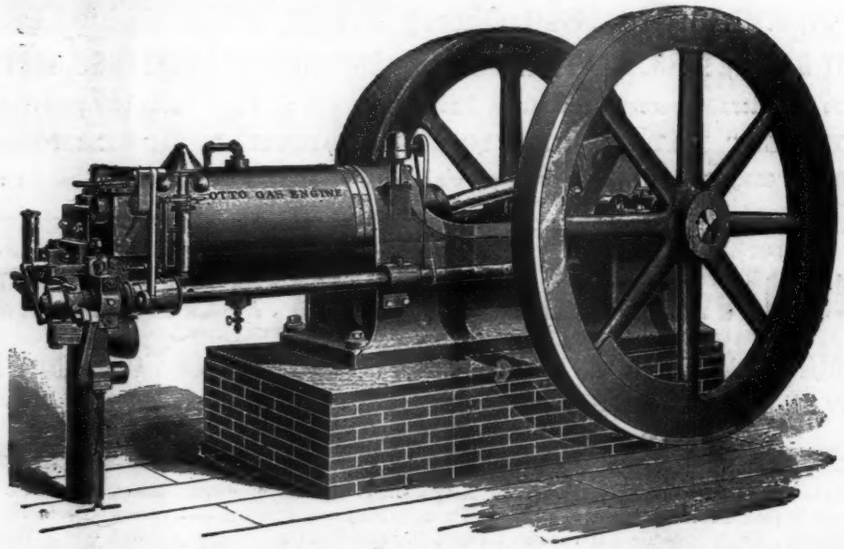

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